



The Use of Single Patient Rooms versus Multiple Occupancy Rooms in Acute Care Environments

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2004

**Coalition for Health
Environments Research (CHER)**

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Special Thanks:

Special appreciation is given to the Facility Guidelines Institute (FGI) who identified a critical need for information not currently available and funded this study. The FGI is a 501[c] 3 tax-exempt organization established in 2001 for the primary purpose of funding significant research work in health facility design. FGI has agreed to make the study available free of charge to the public by placing it on two web sites.

We are also indebted to Habib Chaudhury, Ph.D., Atiya Mahmood, Ph.D., and Maria Valente. Their time, dedication and commitment to creating this landmark document has contributed to making this report a significant contribution to the decision making process of healthcare providers and the design professionals who advise them.

We also wish to thank the Academy of Architecture for Health Foundation for their generous support in assisting with the dissemination of this study.

This CD edition will be distributed at no cost to all AIA Academy of Architecture for Health members (while supplies last) as a result of the funding provided by the Foundation and will be available for sale at a modest cost through the Coalition of Health Environments Research (CHER) web site (www.CHEResearch.org) for others who desire a CD version.

Although the current market trends are leaning strongly toward a single occupancy acute care bed rooms, there is a huge inventory of double occupancy bed rooms still functioning and playing a vital role in the delivery of the nation's healthcare. This report raises questions as to whether double occupancy bed rooms are detrimental to patient care and staff morale. It should be emphasized that, although this document is based on a comprehensive literature search, the remaining components of the study are a pilot sampling only. Ideally, a more comprehensive follow-on survey could be funded and would add to the validity and impact of the findings.

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The Coalition for Health Environments Research (CHER) is a 501(c)(3) not for profit organization dedicated to “promote, fund, and disseminate research into humane, effective and efficient environments through multidisciplinary collaboration dedicated to quality healthcare for all.”

January 2005

ISBN No. 0-9743763-2-9

Published in the United States of America

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www.CHERresearch.org

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The Use of Single Patient Rooms versus Multiple Occupancy Rooms in Acute Care Environments

Executive Summary

A. Review and Analysis of the Literature

An extensive review of literature in the areas of healthcare design, construction and operating cost, hospital management, staff efficiency, infection control and patient outcomes was conducted in order to identify advantages and disadvantages of single versus multiple occupancy patient rooms. The literature search revealed that many articles on the relationship of design to healing and innovations in hospital design are dated 1980 and later, so this timeframe was chosen for the systematic journal searches. However, relevant articles dealing with room occupancy and patient care issues, and dated earlier than 1980 were also included in the review.

The research questions that guided the literature review were:

1. What are the differences in first cost, operating cost, energy costs and efficiency of management and care delivery in single and double occupancy patient rooms in acute care settings?
2. What are the advantages and disadvantages in disease control and falls prevention in single versus double occupancy rooms in acute care settings?
3. What are the therapeutic impacts (socio-behavioral issues of patient privacy, social interaction and daily functioning) of single versus double occupancy hospital rooms?

The articles, book chapters and reports reviewed were initially divided into four categories: a) First and operating cost of hospitals; b) Health care facility management and hospital design; c) Disease control and falls prevention; and d) Relationship between healing and environment. An in-depth review of the literature revealed that articles in the "Healthcare facility management and hospital design" and the "Therapeutic impacts: Relationship between healing and environment" categories had a significant overlap of foci and issues. Consequently, findings in these two categories were combined. The final three categories [i.e., a) cost, b) infection control and falls, and c) hospital design and therapeutic impacts] were utilized as a framework to analyze the literature, which is presented in the integrated summary document, "*A Review and Analysis of the Literature*." The findings from the literature review are also presented in a chart format in order to provide information in a concise manner. In addition, an annotated bibliography providing a summary of key issues from each article or chapter was developed. Based on the feedback from CHER Research Council on the interim report, several additional pertinent articles have been included in this review and analysis since the time of submission of the interim report. Moreover, sections of the document have been reorganized and/or fine-tuned based on the council's comments.

The following chart illustrates the number of empirical and non-empirical articles or book chapters (total number: 222) reviewed in each of the three final categories:

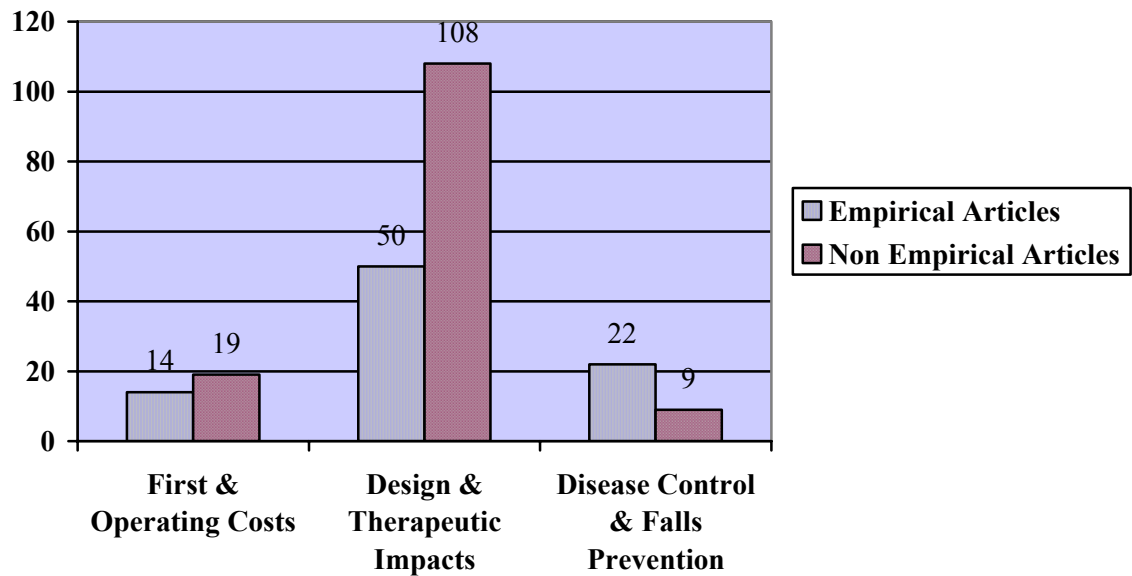


FIGURE 1: The number of empirical and non-empirical articles reviewed under specified categories

Key Findings:

Private rooms are the trend in hospital planning and design. The advantages of single-occupancy rooms are cited as improvements in patient care, a reduction in the risk of cross infection, and greater flexibility in operation. However, it is important to view and interpret the benefits of single-occupancy rooms within the context of patient care issues, other environmental changes and management policy changes in order to bring about desired and sustainable outcomes.

First and operating costs

- Literature focusing on comparative first costs for single and multi-occupancy rooms is scarce. The limited number of articles exploring the relationship between first costs and operating costs indicates that operating costs are proportionately more than the capital cost of hospitals, and this is true even for cost estimates within the first three years of construction.
- Operating costs are reduced in single patient rooms compared with multi-occupancy rooms due to reduction in transfer cost, higher bed occupancy rates and reduction in labor cost. However, this cost reduction can be better achieved when conversion to single room is paired with other healing environment design principles. Cost savings because of reduction in transfers is particularly applicable with acuity-adaptable rooms (Hill-Rom, 2002; Ulrich, 2003).
- Even with higher first or unit costs of construction, furniture, maintenance, housekeeping, energy (e.g., heating and ventilation) and nursing, single occupancy can match the per diem cost of multi-bed rooms because of the higher occupancy rates (Bobrow & Thomas, 2000; Delon & Smalley, 1970).

- A patient's length of stay is associated with hospital costs. Research demonstrates that patients' length of stay in private rooms is shorter, which in turn reduces costs (Anonymous, 2000; Hill-Rom, 2002).
- In comparison to multi-occupancy rooms, medication errors are reduced in single-occupancy rooms, resulting in reduced costs (Anonymous, 2000; Bilchik, 2002; Bobrow & Thomas, 2000; Hill-Rom, 2002; Morrissey, 1994).

Infection Control and Falls Prevention

Infection Control

- Infected patients or patients highly susceptible to infections need to be isolated in private rooms with proper ventilation systems and barrier protections in order to stop infection from spreading or to reduce the possibility of development of new infections. (Anderson et al., 1985; Muto et al. 2000; O'Connell & Humphreys, 2000; Sehulster & Chinn, 2003).
- Prolonged hospitalization is a risk factor for hospital-acquired infections. Additionally, intra-hospital spread of infection may result from patients being transferred to more than one ICU or more than one floor during their hospitalization.
- Patients length of stay in hospitals and cost is increased due to nosocomial infection (Zhan & Miller, 2003; Press Ganey Associates, 2003; Pittet, Tarara & Wenzel, 1994). Ongoing research is demonstrating that nosocomial infection rates are low in private rooms with proper design and ventilation systems (The Center for Health Design, 2003).
- Caution must be used when interpreting results from infection control literature, because the findings and recommendations are often based on retrospective investigations of infection outbreaks in particular settings and are tailored towards those settings. They may or may not be applicable to other settings.

Patient Falls

- Patients who require constant supervision (as in the case of frail and/or delirious patients) are more likely to fall in hospitals; multi-occupancy patient rooms with increased surveillance may be more appropriate for these patients (Jones & Simpson, 1991; Sutton, 1994; Tutuarima et al., 1997).
- Most falls occur in patient rooms, among elderly patients, and when patients are alone or while attempting to go to the bathroom. (Hendrich et al., 1995; Langer, 1996; Pullen, Heikaus, & Fusgen, 1999). However, if provision is made for family members in patient rooms, falls may be reduced due to assistance from family. It is easier to accommodate family in private rooms than in semi-private rooms (Ulrich, 2003).

Health care Facility Management, Hospital Design and Therapeutic Impacts

- Single-occupancy rooms increase patients' privacy, which provides patients with control over personal information, an opportunity to rest, and an opportunity to discuss their needs with family members and friends. The number of patients in a room, the presence of visual screening devices, the location of the bathroom, and the placement of the patient's bed all impact privacy (Bobrow & Thomas, 1994; Burden, 1998; Morgan & Stewart, 1999).
- The influence of room occupancy on type of pain medication usage is mixed. Some researchers discovered that patients in private rooms were more likely to use narcotics than were similar patients in semi-private rooms. This may be due to

decreased environmental stimuli in private rooms. Whereas, others have demonstrated that pain medication intake is less in single occupancy rooms. (Dolce et al., 1985; Lawson & Phiri, 2000).

- It is claimed that health care professionals have more private, and in many cases, more thorough consultation with patients in single rooms than with patients in multi-occupancy units (Ulrich, 2003). Research in this area of patient confidentiality and patient consultation is limited.
- Mixed results were obtained in studies and surveys of patients' preferences for room design. The majority of patients prefer single rooms because of greater privacy, reduced noise, reduced embarrassment, improved quality of sleep, opportunity for family members to stay, and avoidance of upsetting other patients (Douglas, Steele, Todd, & Douglas, 2002; Kirk, 2002; Pease & Finlay, 2002; Reed & Feeley, 1973).
- Patient stress can be reduced if preoperative patients are assigned to rooms with postoperative or non-surgical patients (Kulik, Moore, & Mahler, 1993). Multiple occupancy rooms are associated with lack of privacy, higher noise level and sleep disturbance (Hilton, 1985, Ulrich, 2003).
- *Universal rooms* or *acuity adaptable rooms* are a current trend in design, especially in hospitals that are promoting patient-centered care and family participation in the patient's healing program. These rooms are all private rooms. Results from a limited number of studies have indicated that medication errors, patient falls and procedural problems may be reduced in acuity adaptable rooms (Bobrow & Thomas, 2000; Gallant & Lanning, 2001; Hill-Rom, 2002; Spear, 1997). However, these results may be specific to the particular institutions studied. More detailed study with examples from multiple hospitals is required before drawing specific conclusions.
- Sources of stress for patients are: perceived lack of control, lack of privacy, noise, and crowding (Shumaker & Pequegnat, 1989). Excess noise can lead to increased anxiety and pain perception, loss of sleep, and prolonged convalescence (Baker, Garvin, Kennedy, & Polivka, 1993; Cys, 1999; Hilton, 1985). Single rooms often afford more privacy, reduction of noise and less crowding. Control is greater in private rooms, as patients can adjust settings according to their needs (Shumaker & Reizensten, 1982).
- Music can also help reduce patients' stress. Patients can listen to music in private rooms without disturbing their roommates (Cabrera & Lee, 2000).
- Crowding can contribute to higher blood pressure. The use of private rooms often minimizes the patients' sense of crowding (Baum & Davis, 1980; D'Atri, 1975).

These key findings are summarized in Table 1:

TABLE 1: Categories, issues, and findings related to single versus multiple

Category	Room Occupancy	Issues & Findings
<u>COST</u>	Single-Occupancy Room	<ul style="list-style-type: none"> ▪ Operating costs ↓ ▪ First costs ↑ ▪ Occupancy rates ↑ ▪ Length of stay ↓ ▪ Medication errors & costs ↓
	Multi-Occupancy Room	<ul style="list-style-type: none"> ▪ Operating costs (inconclusive) ▪ First costs ↓ ▪ Occupancy rates ↓ ▪ Length of stay ↑ ▪ Medication errors & costs ↑
<u>INFECTION CONTROL AND FALLS</u>	Single-Occupancy Room	<ul style="list-style-type: none"> ▪ Rate of nosocomial infection ↓ ▪ Patient transfers ↓ ▪ Patient length of stay ↓ ▪ Infections in burn patients ↓ ▪ HCV transmission between patients ↓ ▪ Transmission of hospital-acquired diarrhea ↓ ▪ Falls in patients requiring supervision ↑ ▪ Falls in elderly when provisions are taken ↓
	Multi-Occupancy Room	<ul style="list-style-type: none"> ▪ Isolation for infected patients (inconclusive) ▪ Infections when patients are transferred ↑ ▪ Transmission of hospital-acquired diarrhea ↑ ▪ Patient length of stay ↑ ▪ Access to bathrooms ↓ ▪ Falls in patients requiring supervision ↓ ▪ Falls in elderly when provisions are taken ↓

occupancy

patient rooms based on the literature review

Category	Room Occupancy	Issues & Findings
<u>HOSPITAL DESIGN</u> & <u>THERAPEUTIC IMPACTS</u>	Single-Occupancy Room	<ul style="list-style-type: none"> ▪ Privacy ↑ ▪ Pain medication (inconclusive) ▪ Patient consultation with physician (inconclusive) ▪ Patient preference for room design (inconclusive) ▪ Noise level ↓ ▪ Sleep disturbances ↓ ▪ Acuity-Adaptable rooms (inconclusive) ▪ Patient satisfaction ↑ ▪ Patient control ↑ ▪ Crowding ↑ ▪ Stress reduction through music ↑
	Multi-Occupancy Room	<ul style="list-style-type: none"> ▪ Privacy ↓ ▪ Pain medication (inconclusive) ▪ Patient consultation with physician (inconclusive) ▪ Patient preference for room design (inconclusive) ▪ Benefit of roommates (inconclusive) ▪ Noise level ↑ ▪ Sleep disturbances ↑ ▪ Patient satisfaction ↓ ▪ Patient control ↓ ▪ Crowding ↑ ▪ Stress reduction through music ↓

TABLE 1(Cont'd): Categories, issues, and findings in regards to single versus multiple patient rooms based on the literature review

B. Comparative Assessment of “First Costs” of Single versus Double Occupancy Residents’ Rooms

Based on consultations with Mahlum Architects and Davis Langdon Adamson (Construction Cost Planning and Management firm), the focus of first costs comparison has been expanded from patient rooms and adjacent corridors to include the associated support service areas in the nursing units. Mahlum Architects has assisted us in identifying several nursing unit floor plans with various configurations. However, most of these plans reflect either all single patient rooms or a mix of single and double rooms in the nursing units. Based on the analysis by Davis Langdon Adamson on multiple nursing unit floor plans of various configurations, it is evident that gross area per patient is significantly larger for single patient rooms than for double patient rooms. Most of the other building components correlate to area, rather than patient count. This leads to the conclusion that for the purpose of this study, single patient rooms can be reasonably evaluated based on area per patient.

A dual approach has been taken in comparative first cost assessment between single and double occupancy rooms. The first approach is an overall comparative estimation completed by Davis Langdon Adamson based on ten nursing unit floor plans. Because none of the nursing units consisted of only double patient rooms, the grossing factor was calculated for single patient room floors and for mixed (double and single) room floors. Gross floor area per bed was calculated by multiplying the square footage of the room by the grossing factor for that floor plan type (either single patient or mixed). Based on the analysis of the nursing floor plan samples, gross area per bed can be considered a reasonable indicator of cost per patient for building construction. The cost for construction of a typical patient nursing tower, based on cost analysis of these and other recently built hospitals, is about \$285 per square foot for both types of floor plan.

Two additional floor plans have been analyzed, resulting in a total of ten nursing unit floor plans included in this final cost model. The overall conclusion was not significantly altered by addition of the two hospitals. Using the construction cost and the values for gross floor area per patient calculated, the cost per patient for the two floor plan types (based on ten different nursing units) was as follows:

- \$182,400 per patient – single patient room floor plans
- \$122,550 per patient – mixed room floor plans

Typical Cost Models for Hospital Nursing Tower Construction for single and double rooms are provided in document “*Comparative First Cost Assessment.*”

The second approach provides a cost model that replaces the single rooms of a nursing unit with double rooms. This analysis was done by the quantity surveyor firm, BTY Group, based on one particular nursing unit plan (Swedish Medical Center, Seattle). In this approach, it was assumed that the total patient room areas and half of the corridor areas immediately adjacent to those patient rooms would be reduced by 20%, with the assumption that core services would remain same as that required for the one-bed option in the floor plan. However, in reality these services may require additional spaces in double-occupancy conversion. This cost model includes all direct and indirect building construction costs, and excludes items such as legal fees, professional fees and disbursement, site work, etc. This approach (based on one example) yielded the following cost comparison:

- \$153,000 – single patient room option
- \$134,000 – double patient room option

Nursing unit floor plans analyzed in this cost modelling are as follows:

- Evergreen Hospital, Kirkland. East Wing, 5th floor
- University of Washington Medical Center, Seattle. Wing EC/EB, 4th floor
- Swedish Medical Center, Seattle. Southeast Tower, 9th floor
- Providence Newberg, Oregon. 2nd floor
- Evergreen Hospital, Kirkland. unidentified floor
- San Joaquin General Hospital, California. Med Surg, 2nd floor
- VA Menlo Park, California. Psychogeriatric floor
- University of California at Davis Medical Center, Davis. Davis Tower, 14th floor
- St Luke’s Medical Center, Milwaukee, Wisconsin.
- Valley Presbyterian, Van Nuys, California.

C. Pilot Study on Comparative Assessment of Operational Costs and Patient Care Issues in Single and Multiple Occupancy Patient Rooms

This empirical component of the research documented, comparatively analyzed and synthesized information on use, efficiency and suitability of single and double occupancy med-surgical patient rooms in four hospitals in the Pacific Northwest. We conducted structured interviews with administrators and staff in the following four hospitals: Evergreen Hospital Medical Center, Kirkland, Washington; Swedish Medical Center-First Hill, Seattle, Washington; University of Washington Medical Center, Seattle, Washington; and Providence Medical Center, Portland, Oregon.

Brief descriptions of the hospitals:

Swedish Medical Center-First Hill: Swedish Hospital is the Northwest's largest, most comprehensive medical center, with three campuses: Seattle's First Hill, Swedish Medical Center/Providence and Swedish Medical Center/Ballard. Swedish Medical Center-First Hill is the flagship campus, with 697 beds.

Evergreen Hospital Medical Center: Evergreen Healthcare is a community-based health care organization serving more than 400,000 people in the Northwest. Evergreen Hospital Medical Center is a 244-bed acute care hospital in Kirkland, Washington.

University of Washington Medical Center: The University of Washington Medical Center is a comprehensive medical care facility. It is rated among the top dozen medical centers in the United States. Number of beds is 450. Inpatient admission in 2002 was 16,517, and total operating expenses were more than \$436 million.

Providence Portland Medical Center: The Providence Portland Medical Center is located in the Portland metro area, with 483 beds and admissions of 22,646 in 2000.

Data Collection

We developed two questionnaires to gather data on staffing, patient care issues and operational costs. The first questionnaire focused on hospital background information, staffing patterns in nursing units, comparative assessment of single versus double patient rooms and some operating cost issues. This was used with an appropriate administrative staff member in each of the four hospitals. The second questionnaire focused primarily on comparative assessment of single versus double patient rooms in terms of patient care and staff efficiency. This questionnaire was used with frontline nursing staff (e.g. nurse managers, charge nurses, nurse aides and other health care personnel) at each hospital. There is some overlap of the questions on the two questionnaires. We believed that it was important to gather multiple viewpoints (from both administration and nursing unit staff members) on certain issues of advantages and disadvantages of single versus double patient rooms.

In order to identify relevant issues and variables for a comparative assessment of operating costs with an emphasis on staffing and maintenance costs, we consulted with several administrative and nursing staff members at those four hospitals either in person or over the telephone. It became apparent that there is no systematic built-in mechanism for documenting staff efficiency and patient care factors, and their associated operating cost figures in these four hospitals. For example, although anecdotal experience indicates that considerable time is spent on patient transfers, there is no existing data on the actual time spent on the related tasks at the hospitals. Given the scope in time and financial resources of this current study, we gathered experience-based data on these issues. We believe that in order to fully examine the factors that have relevance for operational costs associated with single and multi-occupancy rooms (e.g., reduced transfers, effect of single rooms on infection rates, easier surveillance), an expanded study with a specific focus on these issues should be considered in the future.

Key Findings

Data from the semi-structured questionnaires was analyzed using SPSS for Windows software. Descriptive statistical analysis was performed on the quantitative data to provide comparative assessment on single versus double patient rooms. Participants represent various levels of nursing staff. The findings need to be viewed within the context of the limited sample size of this pilot study (Nursing staff N=73; Administrative staff N=4). In comparing single- versus double-occupancy rooms, it is evident that nurses clearly favored single-occupancy rooms. Most of the participants responded more favorably for single rooms than for double rooms on the majority of the fifteen categories in the comparison questions. The most noticeable categories of positive assessment for single rooms include: flexibility for accommodating family, suitability for examination of patients by health care personnel, patient comfort level, patient recovery rate, less probability of medication errors, and less probability of diet mix-ups.

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- The respondents rated many environmental characteristics of single patient rooms as helpful. These included the layout of the room (47 percent), the availability of space in rooms (49 percent), the arrangement of furniture (47 percent), privacy (89 percent), and space for family members (51 percent).
- Double-occupancy rooms were thought to be somewhat helpful in terms of walking distance from the nursing station (41 percent) and visibility of the patients for monitoring purposes (40 percent)
- Surveillance of patients was considered somewhat problematic in both single- (40 percent) and double-occupancy rooms (34 percent).
- The most common reason given for a transfer request was privacy (52 percent), followed by patient behavior issues (36 percent) and infection control (27 percent). Future studies may rely on multi-method data collection, such as observation and log entries, as well as respondent surveys, in order to gain more accurate information on the tasks, time and cost involved in patient transfer.
- Staff efficiency is greater in single-occupancy rooms, according to more than half of the study participants (53 percent), and 58 percent of nurses noted that patients use less medication in single-occupancy rooms.
- Respondents felt that single-occupancy rooms have better access to bathing facilities (93 percent), more space for storage and equipment (86 percent), and are better suited for different ethno-cultural groups and family members (96 percent) compared to double or multi-occupancy rooms.
- Eighty-four (84) percent of the respondents rated room flexibility as high or very high in single-occupancy rooms, whereas only 40 percent of nurses felt double-occupancy rooms are moderately flexible.
- Single-occupancy rooms were chosen as most appropriate for patient examination (85 percent) and collection of a patient's history (82 percent) compared to less than half of the respondents rating double-occupancy rooms as low in their suitability for patient examination and collection of a patient's history.
- Fifty-seven percent of the respondents stated that the rate of acquiring a nosocomial infection is either low or very low in single-occupancy rooms, compared to 11 percent respondents stating that the rate is high or very high in single rooms. As for double rooms, 10 percent respondents felt that the rate of acquiring a nosocomial infection is either low or very low, compared to 46 percent respondents stating that the rate is high or very high in double rooms.
- The incidence of patient falls was considered moderate in both types of rooms (48 percent). Similarly, the rate of taking pain reducing or sleep inducing medicine was considered moderate in both types of room (37 percent in single-occupancy rooms; 33 percent in double-occupancy rooms).

The primary objectives of this pilot study were to gather an experience-based assessment from hospital staff in regard to single versus double patient rooms and to examine the validity and relevance of the two survey questionnaires. The results generally support the positive aspects of single rooms from a patient care perspective, as suggested by the literature. The limitations of this study include limited sample size and limited data on operating costs. Findings need to be interpreted with these limitations in mind. Future studies need to examine carefully the implications for operating costs of the positive assessments of patient care issues associated with single rooms. An in-depth case study approach using multiple methods (e.g., systematic observations, information from data logs, qualitative interviews) can provide more useful

data in regard to the complex relationships among patient care issues, operating cost variables, patient outcomes, and staff efficiency, as well as subjective evaluations by patients and family members. See the document *Pilot Study on Comparative Assessment* for full report.

Issues for Future Research:

It is evident from this research project that in order to better understand the advantages and disadvantages of single versus double rooms, future research needs to examine the effects of design of patient rooms and nursing units, staffing, care procedures and practices on operating costs. Although cost of construction is an important factor in the consideration of single versus multi-occupancy rooms, room area and design of patient rooms, nursing unit configurations, etc., it is relatively insignificant over the lifetime of the building. Eventually, the operating costs become the truly relevant factors in terms of seeking out efficient and meaningful strategies in design, staffing and care delivery that can positively impact cost containment and reduction.

In this study, we provided comparative first cost analysis of single and double occupancy patient rooms. However, issues related to operational cost was only covered through some experiential data provided by the frontline staff at the four study hospitals. We believe that future studies could be designed with an in-depth methodology by collecting concrete data with direct staff input over a period of time, and focusing primarily on specific patient care tasks/activities and their relevance to operating costs. Multi-method of data collection including observation, information from data logs and interviews is required to gain more detailed information. However, in order to have a meaningful understanding of the associated issues, measurement of operating cost with variables such as staff travel time, paperwork, maintenance, infection control, transfer, etc., need to be conducted along with the variables of a therapeutic environment. It is important to recognize the apparently intangible benefits of a patient-focused and positive environment on patient satisfaction, morale and self-efficacy.

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The Use of Single Patient Rooms vs. Multiple Occupancy Rooms in Acute Care Environments: Review and Analysis of the Literature

Overview

Aging of the population in the United States has resulted in increased prevalence of chronic and acute conditions that require hospitalization and this will play a central role in driving the future demand of inpatient care (Ulrich, 1992). Demographic changes (e.g., the aging baby boom generation, increasing life expectancy and continued immigration) could result in a 46 percent increase in acute care bed demand by 2027 (Solucient, 2003). One effect of increased acuity in patients is that hospitals are designing inpatient care units much more like critical care units. Nursing stations are being designed to allow for closer proximity of nurses to the patients and to other nurses. According to Burmahl (2000), built-in flexibility in design is becoming more crucial, mainly because technology is quickly obsolete and patient populations are constantly changing. Today's patient room may be tomorrow's intensive care unit, so flexibility is essential. However, the trend is also to design therapeutic environments --wellness-oriented, healing environments -- that incorporate family-centered care and include organic elements like natural light, plants, water, color and texture in their design schemes. In recent years, health care designers and administrators have become more aware of the need to create patient centered and psychologically supportive acute care environments (Gerteis et al., 1993; Ulrich, 1999). The challenge is to design patient rooms to be more like intensive care rooms, yet achieve a better healing environment. How does the need to address increased acuity, as well as the need to promote therapeutic outcomes affect patient density issues in patient room design?

Single patient rooms have become the industry standard in new construction of acute care facilities in the United States. Healthcare design professionals and planners argue that private patient rooms reduce the possibilities for infection, facilitate nurses and healthcare workers' ability to do their jobs efficiently, provide adequate spaces for family members to participate in the healing process of the patients, and afford a greater measure of privacy for the delivery of bedside treatments and for sensitive discussions with health-care personnel (e.g., Bobrow & Thomas, 2000; Gallant & Lanning, 2001; Hill-Rom, 2002; Hohenstein, 2001; Solovy, 2002, Ulrich, 2003). Additionally, they claim that this type of room design reduces noise levels and traffic in and out of patient rooms and contributes to a reduction in patient stress levels, which in turn results in faster healing time for the patient (e.g., Bacon, 1920; Cabrera & Lee, 2000; Tate, 1980). However, are these claims supported by empirical evidence?

An extensive review of literature in the area of healthcare design, construction and operating cost, hospital management, staff efficiency, infection control and patient outcomes was conducted to identify advantages and disadvantages of single versus double occupancy patient rooms. The research questions that guided this review are:

- 1) What are the differences in first cost, operating cost, energy costs and efficiency of management and care delivery in single and double occupancy patient rooms in acute care settings?
- 2) What are the advantages and disadvantages in disease control and falls prevention in single versus double occupancy rooms in acute care settings?
- 3) What are the therapeutic impacts (socio-behavioral issues of patient privacy, social interaction and daily functioning) of single versus double occupancy hospital rooms?

To address the study research questions and facilitate the review and analysis process, the articles and chapters reviewed were divided into four categories. Additionally, the articles in each category were subdivided into empirical and non-empirical articles. Articles that presented primary data and findings from a research project were grouped under the “empirical” sub-category. Articles and chapters that were either reviews of other studies or prescriptive in nature, or that covered general descriptive information were grouped under the “non-empirical” sub-category. The four general categories of the literature review are as follows:

i) First and operating cost of hospitals

The review included articles that discussed issues that affect first and operational costs of acute care settings. Most of the articles in this section were non-empirical in nature and provided a general overview of cost factor in acute care settings. An extensive literature search revealed a limited number of articles that addressed cost factors relative to room occupancy.

ii) Health care facility management and hospital design

In this section, literature on current hospital design trends and the reasons behind these trends were reviewed. Additionally, some literature on hospital management was reviewed. The literature searches were also conducted on nursing unit layout, room occupancy rates, patient transfers, efficiency related to medical procedures and staff walking distance. There were more non-empirical articles in this section.

iii) Disease control and falls prevention

The review of literature in this category included articles on nosocomial infections in hospitals and their relationship to environmental factors. Articles on falls in hospitals were also reviewed to identify any linkages to the built environment and design.

iv) Therapeutic impacts: Relationship between healing and environment

This section mainly dealt with articles and chapters that discussed the contribution of environmental factors to the healing process. It covered issues of room size, acoustics, room location, ambient characteristics, privacy, confidentiality and stress reduction. Many of the articles in this section were empirical in nature and provided useful information on health outcomes as they relate to built environmental factors.

The articles in the “Healthcare facility management and hospital design” and the “Therapeutic impacts: Relationship between healing and environment” categories are interrelated and have overlapping ideas and issues. Though these two categories are separate in the annotations and summary charts (see Appendices A and B), highlights from the findings in these two categories are combined later in this summary section due to their interrelated nature.

Literature review methods

Several strategies were used to identify potential studies/articles for the review. First, a keyword search of relevant databases was conducted. The databases searched were: Medline, EBSCO Host, ABI/Inform, Ageline, Clinical Reference Systems, Digital Dissertations, Healthsource: Nursing and Academic, JSTOR, PsycINFO, Science Direct, EMBASE, Pubmed, World Cat, Social Sciences Citation Index, Simon Fraser University and affiliated libraries’ catalogues. Second, potential studies were identified by a systematic review of issues of relevant journals/magazines in the area of healthcare design, management and infection control.¹ The literature search demonstrated that many articles on the relationship of design to healing and innovations in hospital design are dated 1980 and later, so this timeframe was chosen for the systematic journal searches. However, relevant articles dealing with room occupancy and

¹ Journals/magazines/newsletters searched for relevant articles:

- Architecture and design – *Journal of Healthcare Design, Hospital Design, Journal of Healthcare Interior Design, Journal of Architectural and Planning Research.*
- Hospital and healthcare - *Journal of Healthcare Management, Managed Healthcare Executive, Health Facilities Management, Hospitals, Hospital and Healthcare Network, Modern Healthcare, Healthcare Forum Journal, American Journal of Infection Control, Journal of Hospital Infection, American Journal of Critical Care, American Journal of Nursing, Facilities Design and Management, Health Services Management, Nursing Times, Critical Care Nursing Quarterly, Healthcare Financial Management.*
- Social, Psychological and Behavioral issues- *Social Science and Medicine, Journal of Environmental Psychology, Environment and Behavior, Behavior Research and Therapy, Health Psychology, Journal of Personality and Social Psychology.*
- Others: *The Gerontologist, Canadian Journal of Aging, Journal of Gerontology (Psychological and Social Sciences), Journal of Gerontological Nursing, Journal of the American Geriatrics Society.*

patient issues and dating earlier than 1980 were also included in the review. Finally, the reference lists for included articles that dealt directly with room occupancy issues were inspected. In each case, articles and chapters that were potentially relevant were collected and assessed for appropriateness.

Keyword searches included: hospital design, healthcare facility design, acute care, hospital planning, hospital management, single occupancy rooms, private rooms, semi-private rooms, multiple occupancy rooms, double occupancy rooms, patient rooms, ward design, isolation and infection control, cost analysis in hospitals, first cost, energy cost, operating cost of hospitals, falls incidence and prevention, patient occupancy rates, patient transfer, design and well-being, patient-centered care, cooperative care, health and environment, social interaction, privacy, nursing efficiency in hospitals, etc.

The formats of the charts for empirical and non-empirical articles are as follows:

Chart format for empirical studies:

Study	Focus of study	Research Design	Sample information and site	Findings	Relationship of findings to room occupancy

Chart format for non-empirical articles and chapters:

Article	Focus of article	Type of healthcare facility	Recommendations for healthcare settings	Relationship of recommendation to room occupancy

The following graph (Figure 1) provides the number of empirical and non-empirical articles reviewed under each category of the literature review. It illustrates to the reader the type and quantity of the articles reviewed.

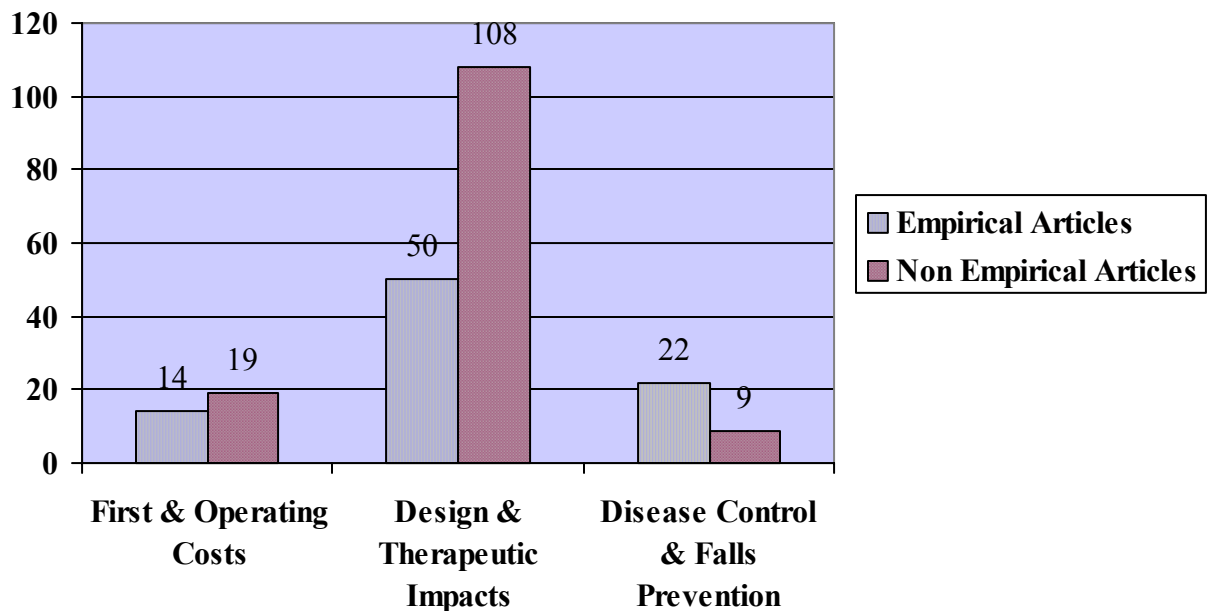


FIGURE 1: The number of empirical and non-empirical articles reviewed under specified categories

The next section provides an historical overview of hospital development and patient room design. This is followed by highlights from the review and analysis of literature.

Historical Overview and Context

The healthful environment it provides for patients, the amount of privacy it allows patients, the extent to which it exercises supervision and control over patients, and the efficiency with which it can be operated. These we call the four elements of ward design.

Thompson & Golden, 1975, p. xxviii

Today [in the United States] the patient room is seen as a place of sanctuary, privacy and safety—the place where the patient and the family are in control of their lives and environment. The patient room can now house the family, if necessary, and can be designed as an extension of the daily life of the patient, with total access to the world.

-- Bobrow & Thomas 2000, p. 132

As background for the review of literature, this section provides a brief overview of the development of the hospital as it relates to patient room issues. The hospital, as it is known today, has undergone various changes throughout past centuries. Verderber & Fine (2000) identified six periods in history through which hospital design has evolved. These include the Ancient era, the Medieval period, the Renaissance, the Nightingale era, the Minimalist

Megahospital and the Virtual Healthscape. Among the first four periods, the Nightingale era is most relevant in terms of room layout and occupancy.

Based on her nursing work during the Crimean War, Florence Nightingale wrote two seminal books, *Notes on nursing* (1858) and *Notes on hospitals* (1859), in which she spelled out her theories on nursing practice, hospital planning and design.² She was a strong proponent for large multi-occupancy wards (over 30 patients), favoring them over private rooms and small-scale wards because she wanted to improve the work environment for the nursing staff (Jones, 1995). Nightingale argued from the point of view of staff efficiency, and highlighted the ease of supervision and better quality of care, as well as the spaciousness in large multi-occupancy wards compared to private rooms. She indicated that benefits of staff efficiency and increased health status (as in multi-occupancy wards) outweighed the need for individual privacy (as in single-occupancy rooms) (Seymer, 1954). Nightingale's reforms, as well as advancement in medicine, resulted in hospitals that were places of healing rather than places of dying. This in turn resulted in hospitals being used not only by the poor, but also by the wealthy. People from the upper income groups wanted privacy during their healing process, so they created a demand for single-occupancy rooms. Gradually, private and semi-rooms replaced multi-bed large wards in hospitals and, by the mid-twentieth century, the Nightingale ward was a dying template (Miller & Swensson, 1995). However, in the 1950s and 1960s, many hospitals still favored open smaller wards over private rooms because of the staff efficiency issue. Even in the early 1970s, advocates of multi-occupancy rooms were stating that patient privacy (in single occupancy rooms) meant a sacrifice of continuous supervision. They attributed the trend towards single rooms in hospitals to the general movement towards privacy in all aspects of 20th century life (Thompson & Golden, 1975). The all-private-room argument was waged mainly as a reflection of societal progress rather than on the basis of strictly rationalized medical justification (Verderber & Fine, 2000).³

² Her guidelines for hospital reform addressed the maximum allowable width and length of a ward, the size of windows and their placement in relation to the bed, the overall ambience, the heating and ventilation systems, and the use of specific materials and colors. St Thomas Hospital in London, which opened in 1871, was the first hospital that used her guidelines in the planning of its wards (Verderber & Fine, 2000).

³ Countries that have some form of universal healthcare coverage (e.g., Britain, Canada), patients pay more for private rooms, thus a majority of the hospitals have more small scale wards (four to six patients) and double occupancy rooms than single patient rooms. These types of multi-occupancy patient rooms continue to find medical, religious, economic and social justification in many developed and developing countries.

According to Verderber and Fine (2000), the United States was one of the first countries to reject the multi-bed ward concept. This shift began after the Second World War and was nearly complete by the early 1970s (with the exception of some urban charity hospitals and large state-run institutions). Although the trend was to develop all private rooms in hospitals, such inpatient facilities often compounded the patient's sense of alienation, dislocation and fear that is part and parcel of the hospitalization process (Verderber & Fine, 2000). By the 1970s some hospital designers began to lobby for hospitals that offer several variants of the medical-surgical units, consisting of a mixture of private rooms, double occupancy rooms, and small wards of up to six beds (Verderber & Fine, 2000). In the past two decades, hospitals in the United States have tended to build more private patient rooms and most renovations done or planned for the future have also favored maximizing single-bed rooms.

Though private patient rooms gained popularity in the latter half of the twentieth century, advocates like A. Bacon, Superintendent of Chicago's Presbyterian Hospital, were recommending them from the early part of the 20th century. Bacon (1920) argued that this type of room design not only provided patients more privacy and comfort, but also addressed the hospital's goal of maximum occupancy. Recent publications (e.g., Bobrow & Thomas, 2000) have provided support for his claim by stating that almost 100 percent occupancy can be achieved in single occupancy rooms versus 80 percent occupancy in double or multi-occupancy rooms. Bacon (1920) also mentioned that hospital-acquired infections were reduced in single rooms and that medical personnel were better able to examine patients and to collect more complete medical histories due to the privacy afforded in this type of rooms. Recent studies on infection control (e.g., Kappstein & Daschner, 1991; Muto et al. 2003; Shirani, et al. 1986) support his claim on mitigation of contagion. Ulrich (2003), in his presentation on evidence-based design, stated that a significant number of studies demonstrate that nosocomial infection rates are reduced in single versus multiple occupancy patient rooms, even when controlling for hand washing practices and air quality (the two other key factors affecting control of nosocomial infection).

Preliminary results from ongoing studies (Rich, 2002) support the examination and patient history part of Bacon's (1920) claim. Additionally, in their study of maternity rooms, Janssen, et al. (2001) discovered that nurses were better able to respond to the needs of patients in single-occupancy maternity rooms, equipment was easily accessed, and privacy was increased. Nguyen, et al. (2002) mention that in their study on patients' satisfaction with their hospital stay

and care, patients in private rooms were more satisfied with the hospital environment, the staff, and the overall quality of care. Present studies verify that there is merit to Bacon's early 20th century claims about the benefits of private rooms.

In "Building type Basics: Healthcare facilities," Bobrow & Thomas have highlighted different advantages of private patient rooms. According to them,

[In single patient rooms] the patient can rest undisturbed by a roommate's activities. A patient can become ambulatory earlier when the toilet and shower are in the room, and such rooms can be used for many types of isolation. Because patients in single-bed rooms are rarely moved, medication errors are greatly reduced [There is a reduction of patient transfer cost for the institution].... In units with multi-bed rooms the number of daily moves has averaged six to nine per day, at a significant cost in added paperwork, housekeeping, patient transport, medication instructions, etc.

-- *Bobrow & Thomas, 2000, p. 145*

The efficiency and effectiveness of patient room design is tied to a large extent to the nursing unit design. As patient rooms gradually shifted from multi-occupancy to single occupancy units in the United States, the design of the nursing units also evolved. Staff work efficiency, walking distance to rooms and monitoring capacity are all related to nursing unit design and this is true for both multi- and single occupancy patient rooms. Designers and administrators should evaluate the benefits and shortcomings of single versus multi-occupancy patient rooms within the context of the different types of nursing unit layout and design.

The Hill-Burton Program that started in 1947 and remained in operation into the early 1970s gave rise to many of the hospitals built in the suburbs to support the housing constructed during that time (Jones, 1995). Thus, many of the current hospitals in the United States are approximately 40 to 50 years old. Because of the changing demographics, increase in ambulatory care, advancement of technology and increase in patient acuity during admission, medical care is very different than it was in the 1950s and 1960s. Hospital and patient room design and renovation in the 21st century need to address these changing needs and demographics.⁴ Thus, the type of density in patient rooms needs to be guided by design

⁴ The Planetree movement, originated by Theriot in 1978, has tried to address some of these issues and has impacted hospital design by creating an emphasis on patient-centered care. After her negative experience in a hospital, Theriot "founded a nonprofit organization to provide health and medical information aimed at improving the quality of patient care" (Miller & Swensson, 1995, p. 177). The Planetree guidelines place an emphasis on creating a comfortable, soothing, and homelike environment for the patient (Martin et al., 1998). New models of patient care rooms--mainly private rooms--such as acuity-adaptable rooms and universal or family-oriented rooms are being

principles that are patient focused, have therapeutic impacts, reduce inefficiencies and increase staff productivity.

This section provided some background information about the evolution of multi- and single patient rooms in hospitals in the United States. The following sections provide a summary of the findings from literature on the four themes mentioned earlier.

Highlights from the Literature Review

While a number of issues and patterns were discovered about the cost, patient care, management, disease control and therapeutic impact of environmental factors, highlighted below are some of the more pertinent and prominent findings related to cost issues.

First and Operating Costs of Hospitals

Even though staff costs account for around 70 percent of the running costs of hospitals, hospitals are still being built and modernized, not with smooth care processes or savings in operational costs in mind, but in accordance with age-old space and operational models seeking to minimize building costs.

-- Paatela, 2000, p. 2

Healthcare construction cost expenditures have gradually increased over the years. In the United States, this amount has risen from 11.6 billion in 1997 to 18 billion in 2001, and it is expected to rise to 27 billion by 2010 (Coile, 2001; Crosswall, 2001 & 1999). According to Coile (2001), the rise in healthcare facility construction will be driven by the aging of the Baby Boom generation and the expansion of the population to 300 million by this decade. Hospital cost covers a significant portion of the national healthcare expenditure in the United States.⁵ Though there are not many articles exploring the relationship between first costs and operating costs, the consensus among the few that compare these two cost factors is that operating costs are proportionately more than the capital cost of hospitals and this is true even for cost estimates within the first five years of construction.

The review of literature on hospital costs revealed that there are very few articles that address the relationship between hospital's first or operating costs and room occupancy. Most articles

designed to address some of the current patient and staff needs. Description of these types of patient rooms is provided in a following section.

⁵ In 1998, hospital care expenditure was 383.2 billion dollars (33.4 percent of the total health care expenditure) and it is expected to be 649.4 billion dollars in 2007 (30.4 percent of the total healthcare expenditure) (Inglehart, 1999).

on hospital expenditure (e.g., Bachelor & Esmond, 1989; Smet, 2003; Yafchak, 2000) dealt with overall capital or operating cost and methods of cost reduction in hospitals. Some articles (e.g., Berry, 1974; Li & Rosenman, 2001; Hoppszallern, 2003; Woodlander & Himmelstein, 1997) provided comparative cost information in different types of hospitals; others discussed methods of evaluating hospital costs accurately (e.g., Baker, 1998; Doyle et al., 1996; Udpa, 1996, etc.). However, hardly any research addresses how patient room density affects hospital expenditure in terms of first costs. The following discussion focuses on hospital design and operational cost. Even within this category the literature is limited.

Operational costs in hospitals

There are several non-empirical articles/book chapters that mentioned that, in general, operating costs account for over 70 percent of the hospital's overall cost and are usually the same as capital cost within the first three years of construction (Bobrow & Thomas, 2000; Paatela, 2000). Berry (1974), in studying factors that affect hospital costs, determined that wage rate was the most significant factor in explaining average costs; construction costs of the facility did not contribute to the explanation.

Drake (2001), in his article on hospital management and cost, stated that capital improvements (first cost) on a healthcare campus typically account for no more than 10 percent of the total cost of providing care, but efficient designs can lower overall operating costs and enable healthcare providers to administer innovative care in the most convenient, professional and cost-effective environment possible. He further mentioned that patient-focused care has brought about as much as a 10 percent reduction in staff cost without compromising care quality or patient satisfaction.

Paatela (2000) argued that the operational costs of a new hospital or modernized section are as high as the capital (investment) costs within 3 years, and that there is a tendency in the Western world to build hospitals to increase "productivity" and the number of patients treated per staff unit. This requires space arrangements that enable the smooth running of care processes, the delivery of patient-centered care, and the appropriate placement of procedures and treatment, while minimizing the movement of patients and all the unnecessary waiting, reporting and errors this movement entails.

Some authors stated that operating costs are reduced in single patient rooms compared with multi-occupancy rooms due to reduction in transfer and labor cost and higher bed occupancy

rates. Bobrow & Thomas (2000) mentioned that operational costs of hospitals are reduced in single occupancy patient rooms compared to multi-occupancy rooms. They argued that, even with higher first or unit costs of construction, furniture, maintenance, housekeeping, energy costs (e.g., heating and ventilation) and nursing costs, single occupancy can match the per diem cost of multibed rooms because of the higher occupancy rates.⁶ This enables the hospital to take care of the same size population with fewer beds.

In an earlier book on hospital design, Thomas and Goldin (1975) argued that, economically, multiple-occupancy rooms are the most efficient. In these types of rooms, patients can be placed along one corridor, facilitating the supervision of patients and reducing the amount of time nurses spend traveling. Thomas and Goldin proposed a six-bed room, with three beds on each side of the room, as the most economical configuration. Costs associated with nurses' travel time are reduced in multi-occupancy rooms compared to single occupancy rooms. Traffic costs/nurses' travel time costs are higher in private rooms, and this increases proportionately as the number of patients in rooms decreases (Delon & Smalley, 1970). However, staff travel time is only one variable under consideration when designing patient room layout and density. Often the advantages of single-occupancy rooms--for example, improvements in patient care, a reduction in the risk of cross infection, and greater flexibility in operation--may outweigh the greater travel distances (and the related cost values) associated with private rooms.

Berry, Colle, et al. (as cited in Ulrich, 2003) argued that hospitals can reduce costs through reducing density in patient rooms. Their estimates for a hypothetical hospital, Fable Hospital, demonstrated over \$3 million savings in patient transfers cost, over \$80,000 dollars savings through a reduction in nosocomial infections, and over \$3 million savings through a reduction in patient falls and drug costs through upgrading of multi-occupancy rooms to large single occupancy rooms and acuity-adaptable rooms.

Overhead and Administrative Costs

Overhead costs affect overall hospital costs. The volume of patients, bed availability, and the complexity and costs of services influence overhead costs (Smet, 2002). Due to a trend towards greater outpatient care and lower occupancy levels, hospitals are experiencing greater overhead costs (Yafchak, 2000). Woodlander, Himmelstein & Lewontin (1993), in their

⁶ Occupancy of multi-bed rooms can reach up to a maximum of 80-85 percent, whereas single rooms have the potential to reach 100 percent occupancy.

evaluation of administrative costs in U.S. hospitals, discovered that administration cost accounted for an average of 24.8 percent of each hospital's expenditure in 1990.

Transfer costs

In terms of transfer cost, Bobrow and Thomas (2000) indicated that hospitals save money by reducing patient moves in single occupancy rooms. "In units with multibed rooms the number of daily moves has averaged six to nine per day, at a significant higher cost in added paper work, housekeeping, patient transport medication instructions, etc." (Bobrow & Thomas, p. 145).

In Bronson Methodist Hospital's new 348 private room facility, there was a reduction in transfer costs compared to their older multi-bed facility, as demonstrated by initial findings during ongoing research at the hospital. In the old facility, the hospital spent around \$500,000 per year in patient transfers due to problems with roommates or infection-control issues; these problems have been greatly reduced according to the hospital's chief executive (Rich, 2002). Bronson Methodist Hospital, upon adopting all single-occupancy rooms, saved \$500,000 per year in transfer costs, while Clarian Methodist Hospital saved \$5 million per year by building acuity-adaptable rooms (Ulrich, 2003). Patient transfers at the latter facility have decreased by ninety percent and medication errors have also declined (Hendrich, Fay, & Sorrells, 2002). Gallant & Lanning (2001), in their article on acuity adaptable rooms, demonstrated that the less a patient is moved, the greater the reduction in cost. The research they quoted in their article demonstrated that the transfer time from a critical care room to a patient room is approximately seven labor hours. Thus, by keeping a patient in a private acuity adaptable room, the hospital cuts down on the salary cost associated with seven labor hours required for patient transfer.

Berry, Colle, et al. (as cited in Ulrich, 2003) generated some estimates of cost reduction in hospitals through upgrades of multi-occupancy rooms to private rooms, including oversized single-occupancy rooms and variable acuity rooms. They calculated cost reduction estimates for a hypothetical hospital, Fable Hospital, and demonstrated that this hospital could save over three million dollars in patient transfers alone, by upgrading to single occupancy rooms from multi-occupancy rooms.

Length of Stay

A patient's length of stay is associated with hospital costs. The first days of hospitalization are generally the most expensive, regardless of the type of illness (Berry, 1974) and, by decreasing

the patients' length of stay, hospitals can become cost-efficient (Smet, 2002). Gallant & Lanning (2001) stated that patients remaining in one private acuity adaptable room throughout their stay tended to recover faster. Their article illustrated that patient stay was reduced from 9.5 days to 5.4 days in five diagnostic related groups (DRGs) in private acuity adaptable rooms in Linda Loma hospital in California.

According to Jones (1995), patients change their room assignments on average four times during a typical admission. Approximately 40 percent of nursing hours are used to manage patient logistics, time taken away from patient care issues. Studies (e.g., Hill-Rom, 2000) demonstrate that there are more patient transfers from multi-occupancy rooms than from private rooms. Thus, from the perspective of patient transfer issues, private rooms seem to be the more suitable choice than multi-occupancy rooms (more discussion on this issue follows).

Healing Design and Cost

According to some advocates of healing design, hospital designs that address therapeutic goals also help to reduce hospital expenses. Aspects of healing design that lead to cost reduction are as follows:

- Shorter length of stay;
- Lower cost per case;
- Reduced use of stronger drugs;
- Reduced nurse hours per patient;
- Reduced turnover (due to improved staff morale) and reduced costs for recruitment (Coile, 2001b, p.12).

Recent ongoing studies on hospital rooms are demonstrating that using private rooms as part of the healing design process has the potential of reducing length of patient stay in hospitals and thus of reducing pain medication intake in private rooms. Private room design that supports the presence of family members reduces patients' falls incidence (Ulrich, 2003) and may reduce the requirement of nurse hours per patient, because family members are participating in the caregiving process.

Parker (1991) estimated the cost savings in a 300-bed (private rooms) hospital environment that was designed to address patient needs. As a result of shorter patient stays, drug intake reduction and reduction of labor cost, the cost savings in that hospital was 10 million dollars per

year in the early 1990s. Parker argued that the savings in staffing cost alone would justify building a healing hospital. His estimates for 1991 demonstrated that the cost of recruiting a nurse was \$20,000 in the United States. Thus, by reducing the nursing labor requirement the hospital could accrue significant savings. In recent years, the average nurse recruiting cost is between 72,000 and 87,000 dollars a year or \$42-\$50 per hour (O' Neill, 2001 as cited in Coile, 2001b). Based on current expenses and labor cost, Parker's 10 million dollar estimate could mean 15-20 million dollars in savings at present.

The articles/chapters that directly or indirectly related cost to room occupancy demonstrated that multi-occupancy rooms may be cost effective in terms of patient monitoring and staff walking distance. However, private rooms, when they are a part of a healing design process, often reduce operational costs in hospitals through shorter patient stays, a lower nursing labor requirement and drug intake reduction. Additionally, cost may be reduced in private rooms due to a lower falls incidence and better infection control. These latter two aspects are discussed in more detail in the following section.

B. Infection Control and Falls

Infection Control

Since March 28 [2003], SARS [Severe Acute Respiratory Syndrome] has been the focus of my professional life...The epicenter of the [second] outbreak [in the Greater Toronto Area] is my hospital... My hospital will be extensively studied by Health Canada and the CDC[The Centers for Disease Control] to answer why this happened. There is no doubt that the answer will relate to environmental issues. Part of the answer is going to be simple. The standard for healthcare is going to be private rooms for every patient. Many of our rooms have 2 to 4 patients. Tell me if you would check into a hotel where you shared a bedroom with strangers and shared a toilet with strangers and had to walk down the hall for a shower. Why do we accept this standard in hospitals? We have had VRE [vancomycin-resistant Enterococcus], MRSA [methicillin-resistant S. aureus], and now SARS. I may be a surgeon, but some things are obvious. I encourage all surgeons to ask their administrators about plans to create this new type of standard.

-- Feinberg, 2003⁷

The reality is that risk of potential exposure is greater in a double room or open ward than in a private room. This is not necessarily from VRE & MRSA, which can spread by surface contact of things, if the room is not thoroughly cleaned but

⁷ Dr Stan Feinberg, shared this information through an internet listserv. He is currently the Chief of Surgery at the North York General Hospital, Toronto, Ontario.

certainly for anything respiratory (ex. cold, flu, SARS, pertusis/whooping cough).... Cleaning and scrubbing are critical for controlling infection but it is the same for both single- and double-occupancy rooms.

-- *Shelton, 2003*

Antibiotic-resistant pathogens are an important and growing threat in the hospital environment. More than 70 percent of the bacteria that cause hospital-acquired infections are resistant to at least one of the drugs most commonly used to treat these infections (Muto et al., 2003).⁸

Among the various methods recommended for infection control in hospitals, two important environmental factors are isolation and ventilation. Infected patients or patients highly susceptible to infections need to be isolated in private rooms with proper ventilation systems in order to stop infection from spreading and to reduce the possibility of the development of new infections. Rates of nosocomial infection are affected by handwashing practices, air quality, and single- versus multiple-occupancy rooms. In particular, single-occupancy rooms appear to have lower rates of infection than double-occupancy rooms (Ulrich, 2003). Larger-sized, single-occupancy rooms are recommended for infection control as they can accommodate equipment, sinks, and storage (Ognibene, 2000). Preliminary findings at Bronson Methodist Hospital in Michigan demonstrate that private rooms, location of sinks and air-flow design have resulted in a 10 to 11 percent decline in overall nosocomial infections rates (The Center for Health Design, 2003). These findings at Bronson Methodist Hospital indicates that private rooms in conjunction with other design modifications can reduce infection rates in hospitals. However, additional research in multiple hospitals, using similar precautions is required to understand fully the relationship between room layout, air-flow design, fixture placement, patient density and infection control.

Additionally, studies have demonstrated that prolonged hospitalization and intra-hospital patient transfer may increase the probability of infection (Tornieporth, et al., 1996, Wakefield et al., 1987). It was mentioned earlier that private rooms help to reduce patients' hospital stays,

⁸ Nosocomial infections occur in more than two million hospitalizations each year (Haley, R. W. et al., 1985). The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) cited federal statistics that 2 million people in the United States acquire an infection each year while being treated in a hospital for other reasons and 90,000 die as a result. Due to this high incidence of hospital related infection, JAHCO is issuing new standards that go into effect in January 2005. Under the new standards, hospitals will be required to make an infection-control program a major component of safety and performance improvement programs and to perform ongoing assessments to identify risks for transmission and acquisition of infectious agents. (Morrissey, 2003)

thereby reducing their probability of acquiring nosocomial infections, as well as cost associated with such hospitalization.

Isolation

Isolation of patients is one of the recommended precautions to prevent the occurrence of infection and isolation can only be possible through confinement of the patient in a private room, often with specialized ventilation systems. Kappstein & Daschner (1991) suggested that private rooms are needed for patients suffering from staphylococcal pneumonia, skin lesions, or methicillin-resistant *S. aureus* (MRSA), as these patients carry organisms that can lead to environmental contamination, and MRSA has the potential to become widespread. Since proximity to an un-isolated patient with vancomycin-resistant Enterococcus (VRE) can lead to the spread of this infection, patients suffering from VRE also need to be kept in isolation, according to the Society of Healthcare and Epidemiology of America (SHEA) guidelines (Muto et al., 2003). However, some experts in the area of hospital epidemiology have critiqued the SHEA guidelines for being based on evidence that is still inconclusive (Eickhoff, 2003). Thus, caution should be used when interpreting the SHEA guidelines.

Research by Byers et al. (2001) demonstrated that the most important risk factor for acquiring VRE during an outbreak was proximity to unisolated patients who became culture positive during the preceding seven days. Montecalvo et al. (2001) illustrated that the implementation of an active surveillance and isolation program for VRE terminated an outbreak at Westchester County Medical Center. Additionally, this program was cost-effective, with reported annual cost savings of \$189,318. However, these results were based on findings from single outbreaks and may not be applicable to all healthcare delivery sites.

In a study on the transmission of the Hepatitis C virus (HCV) in a hematology ward, Silini et al. (2002) discovered that there was patient-to-patient nosocomial HCV transmission. After having analyzed possible routes of transmission, the researchers recommended several preventive measures that included isolation of patients during neutropenic phases. Allander et al. (1995) also discovered that HCV was frequently transferred from one patient to another in a Hematology ward, and their findings highlighted the need for isolation of patients to reduce the spread of HCV. In another study (Korpela et al., 1995) on hospital-acquired diarrhea, it was discovered that nosocomial transfer of *Shigell* spp. occurred between patients sharing rooms

and toilets. The researchers highlighted the importance of the isolation of patients with diarrhea in a hospital setting.

Most studies discussing the relationship between infection control and the built environment recommended isolation to reduce the spread of infection. However, a recent study (Stelfox, Bates, & Redelmeier, 2003) explored care issues of patients in isolation. The researchers of this study discovered that when patients were in isolation due to infection control, the quality of care they received differed from that of patients who were not in isolation. Stelfox, Bates, & Redelmeier (2003) noted that isolated patients were twice as likely as control patients (patients not isolated) to experience an adverse event during their hospital stay. Supportive care failures, such as falls and peptic ulcers, were more likely among isolated patients, as were incomplete recordings of their vital signs. Hospital stays were also longer for isolated patients and their dissatisfaction with their treatment was greater than that of control patients. The findings from this study were contrary to the findings of other studies that demonstrated that private rooms are beneficial to the patient's recovery process. Additional studies are needed to examine the relationship between infection control, private rooms and patient satisfaction to determine the quality of patient care for isolated patients, as well as the need for isolation for different types of disease.

Ventilation

Ventilation is also critical in the control of airborne pathogens for both protective (burns) and infectious (respiratory) isolation (Marier, 1996). For protective isolation and special procedures, the movement of air relative to adjacent areas must be positive and for infectious isolation, it must be negative (AIA/CAH, 1992, pp.52-54). In particular, patients suspected of having an airborne infectious disease should be placed in negative pressure rooms that receive numerous air changes per hour (Sehulster & Chinn, 2003). During an outbreak of airborne infection, whole units of single rooms may need to be converted to negative pressure rooms in order to minimize transfer to other parts of the hospital.

Centralized, filtered, unrecirculating air handling systems with an efficient preventive maintenance program should keep airborne organisms at a minimum in hospital rooms used for isolating patients (du Moulin, 1989). Du Moulin (1989) argued that the single patient cubicle should be mandatory in the design of intensive care units. Physical separation not only

contributes to a decrease in the spread of endogenous flora, but also serves as a constant reminder and barrier to cross-contamination by unit personnel. In their study on the effects of negative pressure ventilation on the spread of nosocomial infection, Anderson et al. (1985) discovered that, in wards with this ventilation system, secondary spread of Varicella zoster did not occur. The rooms on these wards were single-occupancy, as patients were in isolation.

Various isolation strategies are used to prevent infection during bone marrow transplantation. A study by Passweg et al. (1998) examined whether patients treated in high efficiency particulate air filtration (HEPA) and/or laminar airflow (LAF) private rooms had decreased transplant-related mortality (TRM) in the first year after allogeneic transplantation compared to conventional isolation units. Their findings demonstrated that the use of HEPA and/or LAF to prevent infections decreased TRM and increased survival after bone marrow transplants for leukemia. This finding illustrated that the isolation of patients in private rooms, in conjunction with effective environmental controls (like the use of a proper filtration system or a ventilation system) helps in infection control and reduces patient mortality.

Hospital Stay and Intrahospital Transfer

A study conducted by Tornieporth et al. (1996) demonstrated that prolonged hospitalization is a risk factor for Vancomycin-resistant *Enterococcus faecium* (VREF). Additionally, the researchers discovered that intrahospital spread of VREF may have been facilitated by patients who were transferred to more than one ICU or more than one floor during their hospitalization. These patients had a two to threefold higher risk of acquiring VREF. We know from other studies that hospital stay is reduced if patients stay in single occupancy rooms, and there is less need for transfer in these types of rooms.

Wakefield et al. (1988) assessed the extra costs due to serious *S. Aureus* nosocomial infection and discovered that 77 percent of the cost was related to per diem costs for extra days spent in hospitals, 21 percent was due to anti-microbials for treating the infections and 2 percent was due to laboratory costs. In a recent research, Zhan & Miller (2003) discovered that infection due to medical care was associated with the increase of 9.58 days in hospital stay, 38,656 dollars in excess charges and 4.31 percent attributable mortality. Another study (Pittet, Tarara, & Wenzel, 1994) on the relationship between nosocomial infection in surgical patients, length of stay, costs and mortality rates demonstrated that the surgical intensive care unit stay doubled for patients with infection (their median hospital days was also 24 days longer than patients

without infection) and extra cost attributable to infection averaged 40,000 dollars per patient. It is well known that nosocomial infection is a serious patient safety issue and it is also an economic cost burden (Press Ganey Associates, 2003; Stone, Larson & Kowar, 2002). Recent ongoing studies have demonstrated that nosocomial infection rates go down in single patients rooms with proper design and ventilation systems (The Center for Health Design, 2003). Thus, hospitals may save in operational costs associated with nosocomial infection if patients are isolated in private rooms that have proper ventilation and other infection control protocols in place. Additional research is required to understand the relationship between private rooms, patient length of stay, costs and hospital-acquired infection.

Burn Victims and Immuno-suppressed Patients

Burn victims require added precautions in infection control due to their heightened susceptibility to infections. Shirani et al. (1986) studied burn victims in terms of the spread of infection and mortality. Burn patients in nursing units with a majority of single rooms, with each room containing a sink for hand washing, were less likely to acquire an infection than those in an open ward. Because of this factor, mortality was significantly lower on the closed ward.

Researchers have stated that Immuno-compromised patients may need to be placed in private rooms where positive pressure is maintained. Furthermore, time spent outside their rooms should be minimized, and these patients should be provided with respiratory protection (Sehulster & Chinn, 2003). Due to their suppressed immune systems, HIV patients are more susceptible to infections than are non-HIV patients with similar patient characteristics. These types of patients when hospitalized may require isolation in rooms with proper ventilation, in order to reduce the probability of contracting hospital-related infections (Muto, 2003).

Multiple studies have demonstrated that private rooms with proper ventilation (when required) often optimize the use of appropriate precautions and may facilitate infection control in hospitals.⁹ Private rooms do provide more flexibility in changing from positive to negative pressure ventilation and may be more useful than multi-occupancy rooms for airborne disease outbreaks. However, one factor that should be kept in mind when reviewing infection control

⁹ One has to keep in mind that private rooms by themselves may not be very effective in infection control without proper precautions such as handwashing and use of protective gear. For example, during the recent SARS outbreak in Toronto, transmission problems continued after isolation of patients. The key to curbing the SARS transmission was staff awareness and behavior change. When it is not possible to provide private rooms for all patients, the use of barrier precautions in semi-private room can help reduce transmission.

literature is that findings and recommendations often apply to specific institutions (as the studies are often retrospective investigations of infection outbreaks in particular settings) and may or may not be applicable to other settings; thus, caution must be used in interpreting these results.

Patient Falls

Patient Characteristics

Patient characteristics are critical in determining the occurrence of falls. Older patients and males are more likely to experience an adverse event, as are patients with longer lengths of stay.¹⁰ These adverse events are associated with higher hospital costs (Jones, Simpson, & Pieroni, 1991; Sutton, Standen, & Wallace, 1994). A recent study (Solomon, 2003; Flaherty et al., 2003) on delirious elderly patients (who are highly susceptible to falling) demonstrated that these types of patients were better cared for in a multi-occupancy delirium room rather than in a private room. For patients who require constant supervision (as in the case of frail and/or delirious patients), and who are more likely to fall in hospitals, multi-occupancy patient rooms with increased surveillance may be more appropriate than private rooms.

Patient Rooms

Consistent within the literature is the implication that most patient accidents occur in patient rooms. Hendrich, et al. (1995), for instance, conducted a study at a Midwest teaching institution. They discovered that most falls occurred in patient rooms, in particular when patients were alone and attempting to get to the bathroom. Similarly, in a geriatric facility where the majority of rooms were multiple-occupancy, most falls occurred when patients were in their rooms, alone or with other patients. Seventy-four of the 444 falls occurring in patient rooms took place when patients were alone in the bathroom (Pullen, Heikaus, & Fusgen, 1999). Langer (1996) also noted that most accidents on a surgical and urological unit in Durban happened while patients were on their way to the bathroom. The majority of falls occurred during the day, while patients were in their rooms, and during visits to the bathrooms.

Since the majority of falls occurred when the patients were alone in their rooms, one may argue that shared occupancy is beneficial, as patients can assist each other and call for help when necessary. Interventions, such as greater monitoring by staff members, can also reduce the number of falls that occur (Hendrich et al., 1995). Recent studies (as cited in Ulrich, 2003)

¹⁰ As we have noted elsewhere that single occupancy rooms often reduce a patient's length of stay in the hospital, room occupancy can be shown to have some relevance to patient falls.

demonstrated that patient falls may be reduced in private rooms that have provisions for family members. The presence of a relative to assist the patient to move around the space may result in a reduction in falls. This finding highlights the need to examine patient room design and layout in a holistic manner and to take into consideration different healing design principles, as well as room density issues. The following sections deal with these aspects of hospital design as they relate to patient room occupancy.

C. Healthcare Facility Management and Hospital Design/Therapeutic Impacts

This section of the summary combines information from articles reviewed in both the “Hospital Design and Management” section and the “Therapeutic Impacts of Design” section (see Appendices A & B for summary charts and annotations). The “Hospital Design and Management” section provides insight into innovations in facility design and suggests improvements and additions that are critical to patient care and comfort. The articles reviewed here are usually prescriptive in nature and often do not provide evidence of patient outcomes. Articles included in the “Therapeutic Impacts of Design” section primarily address the effect of supportive design innovations on patients’ health outcomes. These articles are more empirically based and evaluate the impact of the physical environmental factors. As these two sections are interrelated and have overlapping ideas and issues, we decided to combine the information from the annotations of the two categories in this summary. This summary covers nursing unit and patient room design, patient-centered care as it relates to design (including use of the Planetree model in hospitals), and patient room density as it relates to health outcomes, as well as some general physical environmental elements that have a therapeutic impact on patients.

Patient-centered care and design

Hospital design impacts patient care and, recently, has taken a patient-centered approach (Horsburgh, 1995). This approach creates a homelike environment that is functionally efficient (Martin, 2000). The goal of a patient-centered care hospital is decentralization, which brings services nearer to the patient. Rooms should be humane and provide the patient with privacy, dignity, security, and cleanliness (Miller & Swensson, 1995). This type of care structure strongly promotes single-occupancy rooms in acute care settings.

Planetree model

The Planetree model is patient-centered. It focuses on the spiritual, mental, and emotional needs of patients. Emphasis is placed on patient participation and education (Martin, et al., 1998). Patients are urged to read their own medical charts and to learn more about their illness and treatment through the use of a medical reference library (Weber, 1995). Rooms in Planetree facilities are generally private and large enough to accommodate the patient's caregiver (Leibrock, 2000). Patients are in control of their settings, including lighting, temperature, and the television. The environment is also made more homelike through the use of soothing colors and artwork, as well as the ability of patients to bring their personal possessions to the hospital (Voelker, 1994). Nursing stations are decentralized into pods serving three to four patients (Leibrock, 2000).

Various facilities in England, and Griffin Hospital in Connecticut, utilized the Planetree model with double-occupancy rooms. An "L"-shaped room design was intended to give patients a sense of their own space (McTaggart, 1996; Weisman, 1994). At Griffin Hospital, satellite-nursing stations and service clusters of three to four patient rooms were used (Weisman, 1994).

Martin et al. (1998) conducted a study comparing patients on a Planetree ward to those on regular medical units. Planetree patients were significantly more satisfied with their hospital stay and with the unit's environment. Planetree patients also had a greater opportunity to interact with other patients, family members, and friends, and they were more satisfied with the involvement of nurses and with the education they received.

Patient room/nursing unit design and their impact on patient satisfaction and nursing activity

From a nursing standpoint, it's better when patients are closer together. With single rooms, patients are spread out and nurses don't have a line of vision with patients. Nurses don't want to restrain patients and if patients are wandering at night, it is nice to have them grouped closer together when the nurses aren't with them ... From a staff perspective, single rooms may require more staffing. When there are two patients in a room, there is less floor space to clean than if all the patients were in single rooms...From infection control perspective it is nice to have a private room...Time savings are incurred with single rooms as transfers go down....From the patients' perspective, single rooms are better. Many prefer privacy. Confidentiality is an issue-in semi-private rooms, even though you can pull the curtain, the patient next to you and family members of that patient can hear what is being said and the patient knows this.

-- Will Shelton (2003)

An optimal mix of single and multiple occupancy rooms depends on medical, social, and economical factors. In their book on hospital design, Thompson & Goldin (1975) suggested that a minimum of 25 percent of the rooms in hospitals should be single-occupancy. Occupancy rates of 80 percent were considered ideal with this type of room density. Service failures were reduced at this level and the majority of patients requesting admission were accommodated (Thompson & Goldin, 1975). Bobrow and Thomas (2000) stated that near 100 percent occupancy rates could be achieved in private rooms. Thus, from an occupancy standpoint, private rooms are more efficient than multi-occupancy rooms.

As mentioned earlier, the nursing unit design is an important aspect of patient room design and layout. Patient rooms cannot be considered in isolation and they need to be evaluated in the context of nursing unit layout. Nursing unit/ward design is vital to the work performed by health personnel. Over the years, different nursing unit and ward designs have evolved, each having distinct features. Florence Nightingale inspired one of the earliest ward designs. The Nightingale ward is a basic long and narrow open ward with beds arranged down each side (Hosking & Haggard, 1999; Tradewell, 1993; Jones, 1985). The goal of this design is to have clear visibility of all patients on the ward. An average of thirty to thirty-two beds are located on this type of ward, with the nursing station located at one end and the convalescent bay at the opposite end of the ward (Hosking & Haggard, 1999, Tradewell, 1993). Newer designs include the bay ward. This type of design subdivides wards into four-, six-, or eight-bed bays (Hosking & Haggard, 1999).

Various articles have compared the advantages and disadvantages, as well as patient preferences, of the bay and Nightingale wards. Hosking & Haggard (1999) noted, for instance, that Nightingale wards do not enable patients to have their need for privacy met. While bay wards offer more flexibility, privacy, and intimacy, patients have only a limited view of nurses. Anxiety may result if patients are attempting to contact their nurse who, unknown to them, may be unavailable. Other negative aspects of the bay ward include the patient's sense of confinement and increased noise due to the use of more equipment. In a study conducted in Scotland, patients made the transition from open wards to bay wards. Positive aspects of the bay ward included privacy and isolation in the single-rooms. However, nurses found it difficult to track patients. The open ward, on the other hand, offered patients greater opportunity to interact with each other (Rainey, 1990).

Interestingly, Pattison & Robertson (1996) found the majority of gynecological patients preferred the bay ward to the Nightingale ward. Patients on the Nightingale ward thought privacy and contact with nurses was adequate, but noise levels were higher and sleep disturbances were greater than on the bay ward. Those on the bay ward were concerned both with a lack of information regarding the whereabouts of nurses and with the activity on the rest of the ward. Patients also mentioned they felt a lack of auditory privacy.

Evidence from these studies does not clearly support the use of one ward over the other. Each has its advantages and disadvantages, such as lack of privacy and increased noise. Patients, however, at least in the case of Pattison & Robertson (1996), preferred to stay on the bay ward despite its limitations. Thus even studies on patients demonstrated that they prefer reduced social density in their recovery spaces.

The efficiency of a nursing unit is determined by its design more than by its size. In particular, circulation design schemes, such as the double-corridor, circular, and square plans, are the most efficient designs, especially if the unit has more than thirty beds (Thompson & Goldin, 1975). Double-corridor designs, followed by the circular and the single-corridor designs, also appear to be the least costly, and costs increase as the number of square feet per bed increases, since construction costs are higher. Traffic costs are lower on smaller units, as travel distances are shorter (Delon & Smalley, 1970).

In terms of unit size, the optimum has been suggested to be between twenty-five and thirty-five beds. Larger units are arguably more efficient, since better staffing patterns are achieved and fewer medicine units and linen rooms are required. Smaller units are advantageous because supervision of patients is better than on the larger units (Delon & Smalley, 1970).

Trites et al. (1968, 1970) studied the impact of nursing unit design on nursing activity. In particular, the nursing units examined were radial, single-, and double-corridor designs.¹¹ The radial design was superior to the other designs in terms of nurses' traveling time. With the reduction in time spent traveling, nurses were able to spend more time with patients. Nurses

¹¹ In single and double-corridor patterns of ward design, patient rooms are located along one or both sides of the corridor, respectively, and rooms contain four to six beds. A central nursing station is utilized and support spaces are used to supply the unit (Tradewell, 1993). The radial design, on the other hand, centralizes patient care and provides immediate access to the patient (Stichler, 2001).

also had fewer accidents and the lowest rate of absenteeism on the radial design unit. Finally, the majority of nurses preferred to work on the radial design unit. The radial design, however, does have some disadvantages. In particular, lateral expansion of this unit is difficult, and this type of design is not able to accommodate an adequate number of private rooms without wasting core space (Cawood, 1993). This type of nursing unit design is not used much anymore because of its inherent staff inefficiencies, awkward leftover spaces in the center, and the irregular shapes of patient rooms (Verderber & Fine, 2000).

A square nursing unit design is another alternative. This design was effectively utilized in a Georgia nursing home. Patient rooms are located along the perimeter of the design and within forty-five feet of the nurse's station. With bathrooms located along the exterior walls, nurses are better able to observe patients without entering the patient room. Since use of space is maximized, nurses spend less time walking. In turn, morale is high and turnover is low among registered nurses (Fisher, 1982). This type of design is suitable for single-occupancy rooms.

The cluster design encompasses mainly single patient rooms around nursing substations. One nursing station is dedicated as the central one (Tradewell, 1993). This design helps reduce patient travel and the number of people associated with patient care (Jones, 1995). Visualization of patients is increased, and more patient rooms can be located around building peripheries. This design does have disadvantages, though, in that care is decentralized and the social needs of nurses are not met (Stichler, 2001).

The triangular design provides for a maximum number of patient rooms to be located on one floor. This type of design is suitable for single patient rooms. It also reduces travel distance from the nursing station to the patient room. Multiple nursing stations are possible and storage space is centralized. Many current new medical-surgical unit designs are using this type of layout for their nursing units. Negative aspects of this design include limited visibility of patients in remote corners, and difficulty of unit expansion (Stichler, 2001).

The rectilinear design is another possibility for a nursing units. It contains a centralized storage location and is less costly to build than other designs. It has various disadvantages, though, including increased travel distances by nurses (especially when single occupancy rooms comprise the majority of patient rooms), minimal visualization of patients in remote rooms, and a greater space requirement for patient rooms.

According to Burmahl (2000), flexibility in design is important in the design of patient care environments. Flexible design may include decentralization of the nurses' station to allow sub-charting stations to be near the patient's bedside, and to allow for changes to a floor layout within the nursing unit.

Private and semi-private patient rooms

Patient privacy is necessary for the treatment of patients. Privacy gives patients control over personal information, an opportunity to rest, and an opportunity to discuss their needs with family members and friends. The number of patients in a room, the presence of visual screening devices, the location of the bathroom, and the placement of the patient's bed all impact privacy (Shumaker & Reizemstein, 1982).

Single-occupancy rooms increase a patient's privacy (Bobrow & Thomas, 1994, 2000; Solovy, 2002). In addition, Verderber & Fine (2000) noted that, in the 1970s, the U.S. General Accounting Office deemed single-occupancy rooms to be the most cost efficient "in terms of day-to-day operations and initial construction costs" (p. 198). Various hospitals have used private rooms in their designs. For instance, Children's Hospital in Omaha, Nebraska designed private rooms to look like children's bedrooms, with enough space to accommodate family members. Privacy is ensured, and the risk of infection is reduced (Hohenstein, 2001). Bobrow & Thomas (2000) also note that single-occupancy rooms can be used for isolation purposes, thus reducing the possibility of acquiring an infection.

Bacon (1920) foresaw the use of private rooms. Early in the 20th century, he noted that private rooms increased flexibility and enabled hospitals to reach maximum bed capacity. He also suggested that private rooms provided patients with more comfort, as better examinations could take place and the patients could control temperatures based on their needs. Visitation could also be scheduled based on the condition of the patients.

Single-occupancy rooms are cost-efficient. In comparison to multiple-occupancy rooms, medication errors and patient transfers are reduced. For instance, in multiple-occupancy rooms, patient transfers can average from six to nine per day. Also, whereas in multiple-occupancy rooms occupancy reaches an average of eighty to eighty-five percent, in single-

occupancy rooms occupancy can reach one hundred percent. These factors all contribute to increased savings for the hospital (Bobrow & Thomas, 2000).

Administrators at William Beaumont Hospital in Royal Oak, Michigan noted that while the majority of patients request private rooms, the hospital usually does not have any to offer patients. The semi-private rooms in this facility typically have a ten percent lower occupancy rate than the private rooms. This fact, combined with a savings in transfer costs, makes private rooms more viable. Thus, the hospital is converting seventy to eighty percent of its beds into private rooms (Anonymous, 2000).

The ideal patient room at Providence Portland Medical Center is single-occupancy. "Paired rooms," with sufficient accommodation for family members and friends were created from one or two rooms on each ward containing connecting doors. These rooms also have the ability to be converted into intensive care units, with enough space to accommodate necessary equipment. Within these rooms, staff have their own area, which includes the tools necessary to treat patients. Families were also included in the room design, and space was allotted for family members to stay and be secondary caregivers.

Private rooms may not be a feasible design in all cases. Mader (2002) suggested that although private rooms help control the spread of infectious diseases, provide a safer, more efficient layout, and increase patient usage, semi-private rooms are advantageous when patient volume is high. Semi-private rooms require less square footage per patient, but issues, such as those relating to gender and the spread of infections, arise in patient placement.

In Fromhart's (1995) look at long-term facilities, administrators from various facilities had differing opinions on the benefits of private rooms. For one executive in New York, private rooms were seen as the best design because roommate problems are avoided and family members can visit freely and personalize the patient's room. An administrator in Virginia felt that semi-private rooms are more cost-effective, while a director in Texas felt that shared-occupancy in an apartment type setting is more cost-effective.

Nurses in England questioned the use of private rooms. Orr, Farrell, and Portman (2002) believed that patients who need constant monitoring would be worse off in private rooms, as monitoring is made more difficult. Staffing would need to be increased and bed capacity would

be reduced. Another author, in referring to NHS hospitals, suggested that the open ward is best because of increased patient supervision and greater privacy than on bay wards, and cost-efficiency (Anonymous, 1991).

The research results on the influence of room occupancy or type on pain medication usage were mixed. In a comparative study (Dolce et al., 1985) of narcotic use among back pain patients undertaken to explore whether room type was a predictive variable in narcotic utilization, researchers discovered that patients in private rooms were more likely to use intramuscular request-contingent narcotics than were similar patients in semi-private rooms. This may be due to decreased environmental stimuli in private rooms, combined with patient personality variables and medical staff characteristics. The researchers concluded that type of room might not be the only factor affecting pain medication intake; patients' own characteristics, along with staff behavior, may also affect medication intake. Other research (e.g., Vernon & McGill, 1961; Zubek, 1969) demonstrated that there is a relationship between decreased environmental stimuli and increased sensitivity to pain. However, other recent studies (e.g., Hill-Rom, 2002) demonstrated that medication intake is less in single occupancy rooms. More research needs to be done in this area to better analyze the relationship between room density and frequency of patients' narcotics/pain medication usage.

In the year 2000, the Center for Health Design, launched a series of research projects in 10 hospitals that had recently built or renovated facilities according to the Pebble principles.¹² The preliminary results from some of these projects demonstrated the influence of design on patient outcome. Methodist Hospital in Indianapolis and Bronson Methodist Hospital in Michigan are two examples of facilities that are part of this research program and have used the Pebble principles. Clarion Health Partners Inc. renovated the Indianapolis Methodist Hospital's cardiac wing and redesigned its rooms to be acuity adaptable single patient rooms so that the patients would not have to move from critical care units to medical-surgical units. In these rooms the patients can control both the temperature and lighting within the space. Visibility of patients (by the staff) is increased through the use of an interior window, as is privacy, because the window can be made opaque when needed. Falls and transfers have also decreased substantially.¹³

¹²The pebble project utilizes research to document the impact of the hospital environment on patients, family members and staff. An emphasis is placed on identifying the best hospital practices, as well as continuous improvements in design (McMorrow, 2001).

¹³ The number of patient falls dropped 60 percent in these newly renovated units (Rich, 2002).

Bronson Methodist Hospital similarly built a facility with 348 private rooms. The preliminary results from the research conducted in this facility demonstrated a greater reduction in hospital-acquired infections than in previous units. Health care professionals have more private and, in many cases, more thorough consultation with patients in single rooms than with patients in multi-occupancy units. In the old facility, the hospital spent around 500,000 dollars per year in patient transfers due to problems with roommates or infection-control issues; this amount has been greatly reduced according to the hospital's chief executive (Bilchick, 2002; Rich, 2002).

The Barbara Ann Karmanos Cancer Institute was renovated to provide patients with a more pleasant and patient-centered environment. Rooms were made private and larger in size, and lighting and acoustics emphasized. Medication errors and the use of pain medication have been reduced in this facility, thus reducing hospital costs (Bilchik, 2002; Rich, 2002). Though conversion to private rooms did facilitate some of the patient care issues, it was a combination of multiple patient-centered design changes that helped to bring about the above mentioned outcomes. Thus, patient room density needs to be considered in conjunction with other patient-focused design changes in order to achieve therapeutic and cost efficiency goals. Conversion to private rooms (from multi-occupancy rooms) by itself may not provide the desired outcomes.

Saint Louis University Hospital recently introduced a *Delirium Room* to treat patients suffering from delirium.¹⁴ This room is part of the acute care for elderly unit, and key to its existence is the provision of a safe environment. Typically, elderly delirious patients who are agitated are cared for in private or semi-private rooms, isolated from others. They may be placed in physical restraints for protection and given calming medications. However, this new environment is a four-bed room, where 24-hour intensive nursing care is provided without the use of physical restraints and medication to quiet patients is the last-choice treatment. The geriatricians in the hospital found that the elderly patients with delirium do better if they are placed together and cared for in the *Delirium Room* (Solomon, 2003). Mortality on the unit was zero and patient's fall rate near zero during a one-year study period, and the use of medications was comparable to or lower than those found in previous studies on delirious patients. Less than ten percent of patients used sedatives (Flaherty et al., 2003). This study demonstrated that in some specific instances where constant supervision is required

¹⁴ Between 15 and 20 percent of older patients are delirious when they are admitted to a hospital and up to 30 percent become delirious while they are in the hospital (Flaherty, as cited in Solomon, 2003).

and patient safety is critical, multi-occupancy rooms may be preferable to single occupancy rooms.

Variations in single-occupancy rooms

Universal Rooms / Acuity Adaptable Rooms: Within the hospital environment, universal rooms are a current trend in design, especially in hospitals that are promoting patient-centered care and family participation patient healing programs. These rooms are single-occupancy, and their goal is to support the level of care needed by all patients. In other words, any one patient can be placed in any one hospital room and receive the required treatment (Spear, 1997). These rooms are larger than typical hospital rooms, enabling bedside treatment to occur more efficiently. Since patients undergo most of the required procedures in their room, the need to transfer patients is reduced, thus reducing transfer costs (Gallant & Lanning, 2001). Space is also provided for family members to stay, thus incorporating them in patient care (Spear, 1997). Flexibility in these rooms is increased through the use of disabled-access bathrooms. This enables constant patient use of the room (Miller & Swensson, 1995). When these rooms are incorporated into a cluster ward design, the nursing team can readily supervise patients.

Mercy Hospital and Medical Center in San Diego, California is an example of a facility that has incorporated the use of larger rooms. Family members and friends are accommodated in patient rooms and are involved in the care of the patients. The nursing station is decentralized to make monitoring of patients more efficient (Lumsdon, 1993).

Another term for *universal rooms* is *acuity adaptable rooms*. As the name suggests these single patient rooms serve people at different levels of acuity. The proponents of this type of room argue that, with more and more patients coming to the hospital with a higher level of acuity, this type of room is more suitable to address their varying needs. These rooms are single-occupancy and have enough space to accommodate patients as well as family members. Space is also provided for critical care equipment, and the majority of procedures take place in the room, reducing the need for patient transfers. This, in turn, reduces hospital costs. If bathrooms are located on the exterior wall, space is further increased in rooms, allowing for efficient organization of the room (Gallant & Lanning, 2001).

Acuity adaptable rooms are ideal for the changing trends in hospitals. As the aging population increases, those requiring acute hospitalization will increase as well. The proportion of patients

needing intensive care will become larger, and thus services in the Intensive Care Unit will become critical to the hospital (Hamilton, 1999). Acuity adaptable rooms enable patients to receive the critical care needed without being transferred to other units throughout their various phases of treatment. Waiting times transfers are also reduced or eliminated, as they are no longer necessary (Hill-Rom, 2002). One study claimed that medication errors, patient falls, procedural problems, and lab problems are also reduced in acuity adaptable rooms (Hill-Rom, 2002). However, these types of outcomes may be relevant only to the hospital under study and may not be applicable to other settings. More studies on acuity adaptable rooms are required before proposing similar outcomes for other hospitals. When beds are clustered into smaller units (six to nine beds) with decentralized nursing stations, it is expected that visibility of patients will improve and staff will be in close proximity to patients (Hamilton, 1999).

Patient Preference of Room Type

Mixed results were obtained in studies and surveys of patients' preferences for room design. Kirk (2002), for instance, interviewed hospice patients in Leeds, England, in regards to their room preference. The majority of patients preferred a single room because of the greater privacy offered, reduced noise, reduced embarrassment, and improved quality of sleep, and because of being able to have family members stay, and to avoid upsetting other patients. Those preferring a shared room did so because they enjoyed the company and sharing their experiences. Similarly, in the United States, a survey conducted on assisted living facilities resulted in eighty-two percent of those surveyed preferring a private room. Only four percent of people surveyed preferred a shared room. The remaining people did not know or did not have a preference. Of those surveyed, women and those from the western United States were more likely to prefer a private room (Contemporary Long Term Care, 1997).

Other researchers, on the other hand, found results favoring shared occupancy. Of the oncology patients surveyed in a British hospital by Pease and Finlay (2002), thirty-four percent preferred a four-bed bay, while only twenty percent preferred a single-occupancy room. The main factor in selecting the shared room was the wish to avoid isolation. Similar results were found by Reid & Feeley (1973), who conducted a study in the United States. If given the choice, fewer than half the patients surveyed preferred a private room. Double-occupancy rooms were favored because patients had someone to talk to and they felt help was available, if needed, from their roommates. Negative aspects of these rooms mentioned included lack of privacy and high noise levels, especially when patients had visitors.

Previous experience in a hospital influences a patient's room preference. Spaeth & Angell (1968) found that ophthalmic patients with previous experience in hospitals were nine times more likely to prefer a multi-bed room to a single-occupancy room. Those without previous experience were more likely to prefer a single-occupancy room, but only by a small margin. After being discharged, significantly more patients stated they would prefer multi-bed rooms. The number of patients in a room can impact patient behaviors. For instance, in one study, patients in single-occupancy rooms were more likely to experience loneliness and separation anxiety. Those on open wards experienced higher levels of shame anxiety, but were able to express their hostility to a greater extent (Leigh et al., 1972). When a dormitory style ward was divided into two-bed sections by partitions, patients had more positive attitudes toward the environment and engaged in more social and less passive behavior (Holahan & Seagert, 1973).

Ittleston, Proshansky, & Rivlin (1970) also noted that smaller, private rooms gave patients greater freedom in regards to behaviors and activities chosen in their rooms. Roommate assignment can impact patient anxiety and stress. Kulik, Moore, & Mahler (1993) discovered that patient stress can be reduced if preoperative patients are assigned to rooms with postoperative or non-surgical patients, rather than with other anxious, preoperative patients.

Patient Satisfaction

Evaluations made by patients in regards to their hospital rooms affect their satisfaction with their hospital stay. Positive evaluations of their rooms, and of the nursing care received, led to greater hospital stay satisfaction (Gotlieb 2000, 2002). Patients staying in private rooms in a hospital in France were more satisfied with the hospital environment and staff, the information they received, and the quality of care they received (Nguyen et al., 2002).

In a study by Harris et al. (2002), satisfaction with the hospital environment, including the patient room, impacted overall satisfaction. Satisfied patients had larger rooms, windows with a nice view, and easily accessible bathrooms. Their privacy was also protected, and enough space was provided to accommodate family members. In a study by Lawson & Phiri (2000), conducted in England, patients were moved from conventional psychiatric and orthopedic wards to refurbished wards that were mainly composed of single-occupancy rooms. Patients rated their experience and treatment higher on the refurbished wards and were more satisfied with the

appearance, layout, and overall design of the unit. Psychiatric patients also stayed for shorter periods of time, while orthopedic patients required lower levels of analgesia.

Morgan and Stewart (1999) studied dementia patients moved from an older, high-density special care unit to a new, low-density special care unit with private rooms. The family members of the residents were pleased with the private rooms because they were able to personalize the rooms and the patients had greater privacy. Due to less stimulation, disruptive behaviors also decreased on the new unit. Some patients did prefer the old ward due to the proximity between patients and staff, as well as the busy atmosphere. Alzheimer's patients also appear to benefit from the reduced stimulation environment offered by private rooms. Patients in a retirement residence in Iowa were calmer and less agitated when moved to a reduced stimulation unit (Cleary et al., 1988).

Patients appear to prefer single-occupancy rooms. Kaldenberg (1999), for instance, discovered that patients in private rooms were more satisfied with their hospital stay, including their communication with staff members, than patients staying in multiple-occupancy rooms. Patients who had roommates were less satisfied with the noise, cleanliness, and temperature of the room.

When roommates are incompatible, hospitals are likely to incur increased transfer costs.

Roommates can also be a source of stress for patients. Specifically, roommates who are unfriendly, have too many visitors, and are seriously ill can have negative effects on other patients (Ulrich, 2003). Patients in single-occupancy rooms large enough to accommodate family members fare better. Social contact reduces stress and improves patient health. Patient falls are also lower in family-centered rooms since patients are likely to have assistance if they need to get up from their beds (Ulrich, 2003).

Ambient Features of Room Design

A sense of control over their setting is important to patients during their hospital stay. The environment should foster the patients' well being, and it should be convenient and accessible (Lowers, 1999). Poor building design contributes to patient stress. Patients experience a loss of control when their privacy is reduced, when they are not given adequate information, and when they are unable to adjust the lighting and temperature in their rooms (Ulrich, 1999). Environments that are not sensitive to their needs do not enable patients to cope effectively with their stress. This, in turn, can manifest in negative patient outcomes, such as problems with

sleeping and noncompliance with medication (Ulrich, 1997). The design of the patient room communicates to patients the attitude of hospital management toward their needs. Patient satisfaction is increased when the environment is pleasant, comfortable, and relaxing (Baker & Lamb, 1992). Sources of patient stress are perceived lack of control, lack of privacy, noise, and crowding (Shumaker & Pequegnat, 1989). Positive patient outcomes are achieved when the hospital environment incorporates natural light, elements of nature, soothing colors, pleasant sounds, and the ability to control one's environment (Murphy, 2000; Stichler, 2001). The pervasive theme through these articles is the need for a sense of control and reduction of stress for the patient. Single patient rooms provide people with more control over the lighting, HVAC, sound and privacy.

Bed placement is critical in terms of giving patients access to windows in semi-private rooms. Brown (1994) suggested that a problem with semi-private rooms is that both beds are placed on the same wall, thus permitting only one person to be placed next to the window. A solution to this problem is to place the beds on opposite walls or to turn both beds toward the window. A number of researchers (e.g., Beauchemin & Hays, 1996; Neumann & Ruga 1995; Verderber, 1986; Ulrich, 1984) demonstrated the beneficial effects of a natural view and lighting for hospital patients through the decrease of anxiety, reduction of blood pressure and muscle tension, accelerated recovery time, and minimization of length of stay. Another suggestion was for the room to include two windows, so both patients have equal access to the outside (Anonymous, 1971). Although equal access to a window is not an issue in private rooms, Cys (1999) suggested that beds should have an angular placement so that patients can focus on the view outside rather than on what is taking place in the corridor.

Noise in the hospital environment can heighten patient stress. Tolerance of noise is low during illness, and control of noise is important for the recovery of patients (Hosking & Haggard, 1999b). Excess noise can lead to increased amounts of anxiety, pain perception, loss of sleep, and prolonged convalescence. High noise levels can also impact staff members and increase their burnout levels (Cabrera & Lee, 2000). Hilton (1985) noted that patients recovering in large rooms containing two to eight beds found the noise levels unacceptable. Single-occupancy rooms, on the other hand, had acceptable sound levels. Excess noise can be reduced through the use of sound-absorbing ceilings and floor coverings (Ulrich, 2003). Private rooms aid in the reduction of noise. With fewer patients in one room, the amount of noise produced is lower. Duffin (2002) noted that less exposure to noise can facilitate a patient's recovery. Music can

also help reduce patient stress, and patients should be encouraged to listen to music when possible (Lowers, 1999; Ulrich, 1997; Weber, 1995).

Patients can listen to music in private rooms without disturbing their roommates, as would be the case in semi-private rooms. Empirical research has addressed the issue of noise production in hospital rooms. Hilton (1985) conducted a study at three hospitals in a large metropolitan area in Canada. He discovered that noise levels were lower in single-occupancy rooms, whereas rooms consisting of two to eight patients produced unacceptable sound levels. Baker et al. (1993) studied the various types of sounds on a critical care unit. They found that sound levels were highest during room conversation and lowest for background sound. There is a greater tendency to conversation if the room is semi-private or multi-occupancy. Other sources of noise included hall conversation, furniture moving, alarms, and toilet flushing. Two of these four sources are more prevalent in multi-occupancy rooms.

Crowding

Crowding can contribute to higher blood pressure. In a study of inmates, those staying in higher occupancy cells were more likely to have high blood pressure than those in lower occupancy cells (D'Atri, 1975). Crowding also impacts socialization. In a study conducted in a college dormitory with short and long corridors, those on the long corridor with more residents were more likely to perceive dormitory life as hectic and less controllable. They also found it difficult to develop small groups (Baum & Davis, 1980). The elderly living in long term care institutions need enough space to have their needs for privacy and territoriality met. If their needs are not met, patients often exhibit a sense of loss of personal control and a weakened personal identity. The use of private rooms and social lounges often minimizes the patients' sense of crowding (Tate, 1980).

These studies on crowding in other types of environment have implications for inpatient hospitals, where people's physical and/or mental health status may make them more sensitive to issues of crowding. These studies imply that private rooms are beneficial to patients. In private rooms, patients are not subject to others, and thus have a greater opportunity to control their environment such that its negative effects, such as high blood pressure and a loss of personal identity, are greatly reduced.

Other Features of the Environment

As mentioned previously, a patient's sense of control is crucial to recovery. Control can be exercised through various means. For instance, patients can be in control of lighting in the room through the use of bedside dimmers, and they have more flexibility in controlling the light and sound level in their room if they are in single occupancy rooms. Patients should be able to control the temperature in their rooms, since temperatures that are incongruent with the patients' needs may result in stress (Shumaker & Reizemstein, 1982; Williams, 2001). Other controls that can be added in patient rooms are bedside window shades and television controls (Murphy, 2000). Control is greater in private rooms, as patients can adjust settings according to their needs, without having to be concerned about the needs of others. Ulrich (1999) suggests the use of a healing garden, which includes elements of nature such as green vegetation, flowers, and water, may aid in the reduction of stress experienced by patients during their hospital stay.

CONCLUSION

Private rooms are the trend in hospital design. The advantages of single-occupancy rooms are cited as improvements in patient care, a reduction in the risk of cross infection, and greater flexibility in operation. However, the above discussion of hospital costs, infection control, falls reduction, and therapeutic impacts as they relate to room occupancy demonstrates that a simple consideration of room occupancy does not provide a complete picture of patient care, cost or infection reduction issues. Room occupancy issues need to be considered along with other patient care issues, other environmental changes or changes in management policy in order to bring about desired outcomes. A summary of the above discussion is presented in brief bulleted format below followed by a summary chart (see Table 1) illustrating issues that are related to room density.

First and Operating Costs of Hospitals

- Literature focusing on comparative first costs for single and multi-occupancy rooms is scarce. There are a few articles that address operating costs in patient rooms in relation to transfer costs/patient stay (Cho, Ketefian, Barkauskas, & Smith, 2003; Smet, 2002).
- In general, the literature addressing cost issues addresses the health care delivery process and methods of accurate cost estimates (Dexter & Macario, 2001; Cleverley, 2002; Garattini, Giuliani, & Pagano, 1999; Li & Rosenman, 2001; Thompson & Goldin, 1975).

- The limited number of articles exploring the relationship between first costs and operating costs indicates that operating costs are proportionately more than the capital cost of hospitals and this is true even for cost estimates within the first three years of construction.
- Operating costs are reduced in single patient rooms compared with multi-occupancy rooms due to reduction in transfer cost (Hill-Rom, 2002; Ulrich, 2003), higher bed occupancy rates (Bobrow & Thomas, 2000) and reduction in labor cost. However, this reduction in cost can only be achieved when conversion to single rooms is paired with other healing environment design principles.
- Even with higher first or unit costs of construction, furniture, maintenance, housekeeping, energy (e.g., heating and ventilation) and nursing, single occupancy can match the per diem cost of multi-bed rooms because of the higher occupancy rates (Bobrow & Thomas, 2000; Delon & Smalley, 1970). In multiple-occupancy rooms, occupancy reaches an average of eighty to eighty-five percent, whereas in single-occupancy rooms, occupancy has the ability to reach one hundred percent. This contributes to increased savings in operations costs (Bobrow & Thomas, 2000).
- A patient's length of stay is associated with hospital costs. Research demonstrates that patients' length of stay in private rooms is less, which in turn reduces costs (Anonymous, 2000; Hill-Rom, 2002).
- In comparison to multi-occupancy rooms, medication errors are reduced in single-occupancy rooms, resulting in reduced costs (Anonymous, 2000; Bilchik, 2002; Bobrow & Thomas, 2000; Hill-Rom, 2002; Morrissey, 1994).

Infection Control and Falls Prevention

- Infected patients or patients highly susceptible to infections need to be isolated in private rooms with proper ventilation systems and barrier protections to stop infection from spreading or reduce the possible development of new infections (Anderson, Bonner, Scheifele & Schneider, 1985; Muto et al. 2000; O'Connell & Humphreys, 2000; Schulster & Chinn, 2003).
- Caution must be used when interpreting results from infection control literature, because the findings and recommendations are often based on retrospective investigations of infection outbreaks in particular settings, and are tailored towards those settings. They may or may not be applicable to other settings.

- Prolonged hospitalization is a risk factor for hospital-acquired infections. Additionally, intra-hospital spread of infection may result from transferring patients to more than one ICU or more than one floor during their hospitalization. We know from other studies that hospital stay is reduced if patients stay in single occupancy rooms, and there is less need for transfer in these types of rooms (Mulin et al., 1997).
- Patients length of stay in hospitals and cost is increased due to nosocomial infection (Zhan & Miller, 2003; Press Ganey Associates, 2003; Pittet, Tarara & Wenzel, 1994). Ongoing research is demonstrating that nosocomial infection rates are low in private rooms with proper design and ventilation systems (The Center for Health Design, 2003).
- Burn patients in nursing units with a majority of single-occupancy rooms are less likely to acquire an infection than those in an open wards (Shirani, McManus, Vaughan, Pruitt, & Mason, 1986).
- Studies have demonstrated that Hepatitis C virus is often transferred from one patient to another, especially in Hematology wards when patients with the virus are not isolated. The researchers emphasized the need for isolation of patients to reduce spread of HCV in hospitals (Allander et al., 1995, Silini, et al., 2002).
- Studies have demonstrated that hospital-acquired diarrhea may transmit between patients sharing rooms and toilets. It is often recommended that patients with diarrhea be isolated (Korpela et al., 1995).
- A recent research demonstrated some negative consequences of isolation. Isolated patients were twice as likely as non-isolated patients to experience an adverse event during their hospital stay. For instance, supportive care failures, such as falls and peptic ulcers, were more likely among them as were incomplete recordings of their vital signs. Hospital stays were also longer for isolated patients and their dissatisfaction with their treatment was greater than non-isolated patients (Stelfox, Bates, & Redelmeier, 2003). This study points to the need of more in-depth research on the relationship between patient care issues and patient isolation.
- Patients who require constant supervision (as in the case of frail and/or delirious patients) are more likely to fall in hospitals; multi-occupancy patient rooms with increased surveillance may be more appropriate for these patients (Jones & Simpson, 1991; Sutton, 1994; Tutuarima, van der Meulen, de Haan, van Straten, & Limburg, 1997).
- Most falls occur in patient rooms, among elderly patients, when patients are alone and while patients are attempting to go to the bathroom (Hendrich, Nyhuis, Kippenbrock, &

Soja, 1995; Langer, 1996; Pullen, Heikaus, & Fusgen, 1999). However, if provision is made for family members in patient rooms, falls may be reduced due to assistance from family (Ulrich, 2003).

- Although patients in double rooms can assist each other in the event of falls, double rooms also pose a greater challenge for one of the two patients in accessing the bathroom (Pullen, Heikaus, & Fusgen, 1999).

Health care Facility Management and Hospital Design and Therapeutic Impacts

- Single-occupancy rooms increase patients' privacy. Privacy gives patients control over personal information, an opportunity to rest, and an opportunity to discuss their needs with family members and friends. The number of patients in a room, the presence of visual screening devices, the location of the bathroom, and the placement of the patient's bed all impact privacy (Bobrow & Thomas, 1994; Burden, 1998; Morgan & Stewart, 1999).
- Research indicates that the influence of room occupancy or type on pain medication usage is mixed. Some researchers discovered that patients in private rooms were more likely to use narcotics than were similar patients in semi-private rooms. This may be due to decreased environmental stimuli in private rooms. On the other hand, other research demonstrated that pain medication intake is less in single occupancy rooms (Dolce, Doleys, Raczynski, & Crocker, 1985; Lawson & Phiri, 2000).
- It is claimed that health care professionals have more private and, in many cases, more thorough consultations with patients in single rooms than with patients in multi-occupancy units (Ulrich, 2003). Research in this area of patient confidentiality and patient consultation is limited. More research is required before providing more definitive recommendations.
- Mixed results were obtained in studies and surveys of patients' preferences for room design. A majority of patients prefer single rooms because they offer greater privacy, reduced noise, reduced embarrassment, improved quality of sleep, an opportunity for family members to stay, and less likelihood of upsetting other patients (Douglas, Steele, Todd, & Douglas, 2002; Kirk, 2002; Pease & Finlay, 2002; Reed & Feeley, 1973).
- Some patients prefer shared rooms because they enjoy the company and sharing of experiences, as well as the potential for help from roommates, if needed. Patients in single-occupancy rooms are more likely to experience loneliness and separation anxiety,

whereas patients in open wards experience higher levels of shame and anxiety (Leigh, Hofer, Cooper, & Reiser, 1972).

- Patient stress can be reduced if preoperative patients are assigned to postoperative or non-surgical roommates (Kulik, Moore, & Mahler, 1993).
- Multiple occupancy rooms are associated with lack of privacy, higher noise level and sleep disturbance (Hilton, 1985, Ulrich, 2003).
- *Universal rooms* or *acuity adaptable rooms* are a current trend in design, especially in hospitals that are promoting patient-centered care and family participation in the patient's healing program. These rooms are single-occupancy, and their goal is to support the level of care needed by all patients. Waiting times for patient transfer are reduced or eliminated, as transfers are no longer necessary. Space is also provided for family members to stay, incorporating them in patient care. Results from a limited number of studies have indicated that medication errors, patient falls and procedural problems may be reduced in acuity adaptable rooms (Bobrow & Thomas, 2000; Gallant & Lanning, 2001; Hill-Rom, 2002; Spear, 1997). However, these results may be specific to the particular institutions studied. Acuity adaptable rooms are a fairly new development in the area of hospital room designs. More detailed study with examples from multiple hospitals is required before drawing specific conclusions.
- Studies on the patient satisfaction issue demonstrated that patients in private rooms were more satisfied with their hospital stay, including their communication with staff members, than patients staying in multiple-occupancy rooms. Patients who had roommates were less satisfied with the noise, cleanliness, and temperature of the room (Kaldenberg, 1999, Ulrich, 2003).
- Patient satisfaction is increased when the environment is pleasant, comfortable, and relaxing. Sources of stress for patients are: perceived lack of control, lack of privacy, noise, and crowding (Shumaker & Pequegnat, 1989). Single rooms often afford more privacy, reduction of noise and less crowding. Control is greater in private rooms, as patients can adjust settings according to their needs (Shumaker & Reizensten, 1982).
- One problem that may arise in semi-private rooms is that both beds may be placed on the same wall, thus permitting only one person to be placed next to the window (Brown, 1994).
- Less exposure to noise in private rooms can facilitate a patient's recovery. Excess noise can lead to increased amounts of anxiety, increased pain perception, loss of sleep, and

prolonged convalescence (Baker, Garvin, Kennedy, & Polivka, 1993; Cys, 1999; Hilton, 1985).

- Music can also help reduce patients' stress. Patients can listen to music in private rooms without disturbing their roommates, as would be the case in semi-private rooms (Cabrera & Lee, 2000).
- Crowding can contribute to higher blood pressure. The use of private rooms and social lounges often minimizes the patients' sense of crowding (Baum & Davis, 1980; D'Atri, 1975).

Category	Room Occupancy	Issues & Findings
<u>COST</u>	Single-Occupancy Room	<ul style="list-style-type: none"> ▪ Operating costs ↓ ▪ First costs ↑ ▪ Occupancy rates ↑ ▪ Length of stay ↓ ▪ Medication errors & costs ↓
	Multi-Occupancy Room	<ul style="list-style-type: none"> ▪ Operating costs (inconclusive) ▪ First costs ↓ ▪ Occupancy rates ↓ ▪ Length of stay ↑ ▪ Medication errors & costs ↑
<u>INFECTION CONTROL AND FALLS</u>	Single-Occupancy Room	<ul style="list-style-type: none"> ▪ Rate of nosocomial infection ↓ ▪ Patient transfers ↓ ▪ Patient length of stay ↓ ▪ Infections in burn patients ↓ ▪ HCV transmission between patients ↓ ▪ Transmission of hospital-acquired diarrhea ↓ ▪ Falls in patients requiring supervision ↑ ▪ Falls in elderly when provisions are taken ↓
	Multi-Occupancy Room	<ul style="list-style-type: none"> ▪ Isolation for infected patients (inconclusive) ▪ Infections when patients are transferred ↑ ▪ Transmission of hospital-acquired diarrhea ↑ ▪ Patient length of stay ↑ ▪ Access to bathrooms ↓ ▪ Falls in patients requiring supervision ↓ ▪ Falls in elderly when provisions are taken ↓

TABLE 1: Categories, issues, and findings related to single vs. multiple occupancy patient rooms based on the literature review

Category	Room Occupancy	Issues & Findings
<u>HOSPITAL DESIGN & THERAPEUTIC IMPACTS</u>	Single-Occupancy Room	<ul style="list-style-type: none"> ▪ Privacy ↑ ▪ Pain medication (inconclusive) ▪ Patient consultation with physician (inconclusive) ▪ Patient preference for room design (inconclusive) ▪ Noise level ↓ ▪ Sleep disturbances ↓ ▪ Acuity-Adaptable rooms (inconclusive) ▪ Patient satisfaction ↑ ▪ Patient control ↑ ▪ Crowding ↑ ▪ Stress reduction through music ↑
	Multi-Occupancy Room	<ul style="list-style-type: none"> ▪ Privacy ↓ ▪ Pain medication (inconclusive) ▪ Patient consultation with physician (inconclusive) ▪ Patient preference for room design (inconclusive) ▪ Benefit of roommates (inconclusive) ▪ Noise level ↑ ▪ Sleep disturbances ↑ ▪ Patient satisfaction ↓ ▪ Patient control ↓ ▪ Crowding ↑ ▪ Stress reduction through music ↓

TABLE 1(Cont'd): Categories, issues, and findings in regards to single vs. multiple patient rooms based on the literature review

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**Comparative First Cost Assessment of
Single and Multiple Occupancy Patient Rooms**



Context:

Based on consultations with Mahlum Architects and Davis Langdon Adamson (Construction Cost Planning and Management firm), the focus of first costs comparison was expanded from patient rooms and adjacent corridors to include the associated support service areas in the nursing units. Mahlum Architects assisted us in identifying several nursing unit floor plans with various configurations. However, most of those plans reflected either all single patient rooms or a mix of single and double rooms in the nursing units. Based on the analysis by Davis Langdon Adamson on multiple nursing unit floor plans of various configurations, it was evident that gross area per patient is significantly larger for single patient rooms than for double patient rooms. Most of the other building components correlate to area, rather than patient count. This led to the conclusion that for the purpose of this study, single patient rooms could be reasonably evaluated based on area per patient.

A dual approach was taken in comparative first cost assessment between single and double occupancy rooms. The first approach was an overall comparative estimation completed by Davis Langdon Adamson based on ten nursing unit floor plans. Because none of the nursing units consisted of only double patient rooms, the grossing factor was calculated for single patient room floors and for mixed (double and single) room floors. Gross floor area per bed was calculated by multiplying the square footage of the room by the grossing factor for that floor plan type (either single patient or mixed). Based on the analysis of the nursing floor plan samples, gross area per bed could be considered a reasonable indicator of cost per patient for building construction. The cost for construction of a typical patient nursing tower, based on cost analysis of these and other recently built hospitals, is about \$285 per square foot for both types of floor plan.

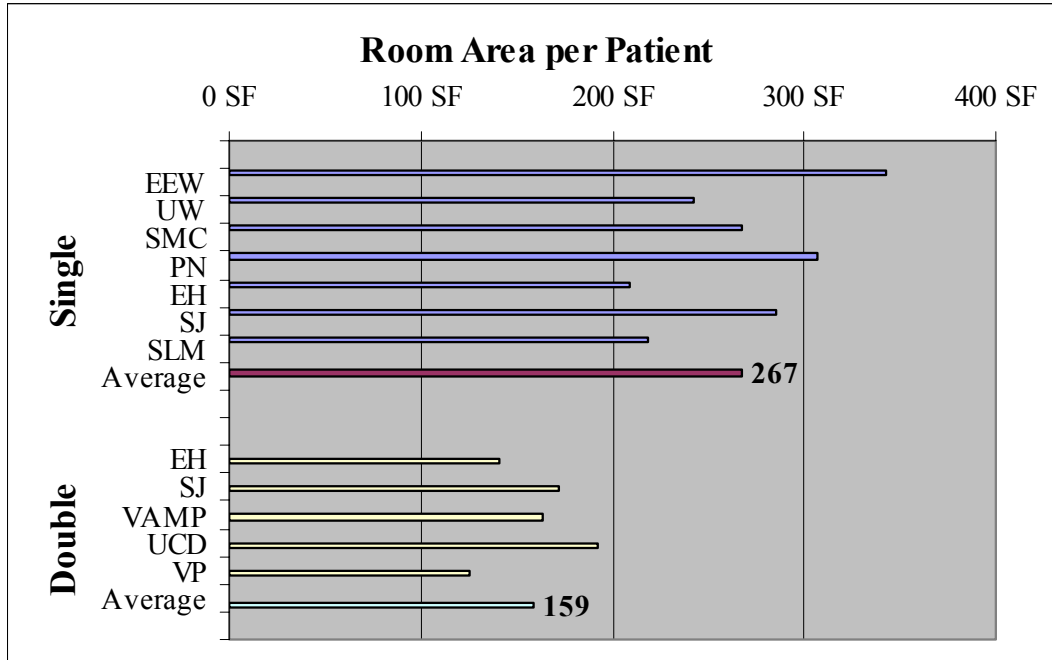
The second approach, complementing the first, provided a cost model that replaced the single rooms of a nursing unit with double rooms. This analysis was done by the quantity surveyor firm, BTY Group, based on one particular nursing unit plan (Swedish Medical Center, Seattle). In this approach, it was assumed that the total patient room areas and half of the corridor areas immediately adjacent to those patient rooms would be reduced by 20% with the assumption that core services would remain same. However, in reality these services may require additional spaces in double-occupancy conversion. This cost model includes all direct and indirect building construction costs, and excludes items such as legal fees, professional fees and disbursement, site work, etc.

Summary

The purpose of the study was to establish a reasonable cost of construction per patient for both single and double occupancy rooms, in support of the overall analysis of the cost and benefits of single versus double patient care. From analysis of ten floor plans of recently constructed patient towers we established the gross floor area per patient bed by taking into account all floor area required for support of patient rooms as well as the area of the rooms themselves. Based on this analysis we recommended using gross area per patient bed to establish cost of construction, since this addressed the core demand of both types of patient room configurations.

Analysis

To establish baseline quantities and costs for single and double patient rooms, we reviewed floor plans for ten recently built nursing floors. These included plans with only single rooms, and plans with a mix of both double and single rooms on the same floor. Mixed plans included double rooms for about 50% of the patients, providing a ratio of about one-third double rooms and two-thirds single rooms. Room area per patient bed for all floor plans is shown in the graph below.



During the analysis it became quite evident that there are significant differences in room size, as determined by the nature of the room. The largest rooms were those for LDRP, closely followed by those designated for Med/Surg. Square foot area ranged from 209 to 342 in the single patient rooms reviewed, while double patient rooms ranged from 141 to 192. However, an average room size could still be calculated despite the noted variations. From these floor plans we were able to establish an average room size for both types of patient care:

Single – 267 square feet
 Double – 159 square feet

While the room area per patient includes bathroom area, it does not take into account the square footage of all non-patient room areas required for maintaining the nursing floors such as nursing desks, laundry and janitorial facilities, and so on. To incorporate these factors we established the typical grossing factor. Because none of the nursing floor models were made of only double patient rooms, grossing factor was calculated for single patient room floors and for mixed (double and single) room floors instead.

The grossing factor was calculated by determining the area of all non-patient rooms necessary for support of the nursing floor, and then dividing that value by the number of patients those non-patient facilities support.

$$Np = \text{Total area of non-patient support facilities}$$

$P = \text{Total number of patients supported by } A$

$\text{Grossing Factor} = N_p / P$

Using this logic, the average grossing factor for each type of floor plan was calculated:

Single – 2.41

Mixed – 2.71

From these calculations we found that the mixed floors typically have a higher grossing factor than do single patient floors. This is to be expected since some of the core functions are proportional to patient count rather than simply room count.

The grossing factor was generated in order to calculate the gross floor area necessary in a nursing floor plan for each bed, beyond the area of the room itself. Gross floor area per bed is calculated by multiplying the square footage of the room by the grossing factor for that floor plan type (either single patient or mixed).

$Gf = \text{Grossing Factor}$

$Rm = \text{Room area per patient bed}$

$\text{Gross Floor Area per Patient} = Gf * Rm$

Using the average room area and grossing factor calculated above, the average gross floor area per patient bed for the two floor plan types is

Single – 640 square feet

Mixed – 430 square feet

Based on the analysis of the nursing floor plan samples, gross area per bed can be considered a reasonable indicator of cost per patient for building construction. This is based on the assumption that the cost per square foot for construction of a nursing floor is irrelevant to floor plan type. Cost per patient for construction can thus be considered equivalent to the average cost per square foot multiplied by the gross area per patient bed.

$Gfp = \text{Gross floor area per patient bed}$

$Csf = \text{Construction cost per square foot}$

$\text{Cost Per Patient} = Gfp * Csf$

The cost for construction of a typical patient nursing tower, based on cost analysis of these and other recently built hospitals, is about \$285 per square foot for both types of floor plans (see the Nursing Tower Typical Cost Models in Appendix II of this report). Using this construction cost and the values for gross floor area per patient calculated above, the cost per patient for the two floor plan types is as follows:

\$182,400 per patient – single patient room floor plans

\$122,550 per patient – mixed room floor plans

During the analysis it became quite evident that there are significant differences in room size, as determined by the nature of the room. This variation in room size should be taken into consideration when planning budgets, as it did become meaningful in the analysis. Following the calculations discussed above, larger room sizes for either type of room could result in an increased cost per patient to build, while smaller room sizes could decrease the cost per patient. Additionally, the use of smaller rooms and thus an increase in the number of patients served in an area could impact the square footage required for support facilities such as laundry rooms, janitorial facilities, and nursing stations. These factors should all be considered when estimating the average cost per patient for new nursing floor construction.

List of Hospital Floor Plans Analyzed

Plans for nursing floors analyzed in this study are listed below.

Evergreen Hospital, East Wing, 5th floor

University of Washington Medical Center, Wing EC/EB, 4th floor

Swedish Medical Center, Southeast Tower, 9th floor

Providence Newberg, 2nd floor **

Evergreen Hospital, unidentified floor

San Joaquin General Hospital, Med Surg, 2nd floor

VA Menlo Park, Psychogeriatric floor

University of California at Davis Medical Center, Davis Tower, 14th floor

St Luke's Medical Center, in Milwaukee, Wisconsin

Valley Presbyterian, in Van Nuys, California

** While the information from the Providence Newberg floor plan was used to calculate the square foot area of the individual patient rooms, this floor plan was not used when calculating the grossing factor, due to the inclusion of a surgical delivery room and a corridor of offices. All other floor plans included only patient rooms or those spaces required for support of patient rooms such as laundry and janitorial facilities, and nursing stations.

Appendix II – Typical Cost Models for Hospital Nursing Tower Construction

Nursing Tower Typical Cost Model
Single Patient Room

COMPONENT SUMMARY

		Gross Area, Single Room:	640 SF
		\$/SF	\$x1,000
1.	Foundations	9.00	6
2.	Vertical Structure	18.00	12
3.	Floor & Roof Structures	27.00	17
4.	Exterior Cladding	35.00	22
5.	Roofing, Waterproofing & Skylights	6.00	4
<i>Shell (1-5)</i>		95.00	61
6.	Interior Partitions, Doors & Glazing	21.00	13
7.	Floor, Wall & Ceiling Finishes	15.00	10
<i>Interiors (6-7)</i>		36.00	23
8.	Function Equipment & Specialties	20.00	13
9.	Stairs & Vertical Transportation	7.00	4
<i>Equipment & Vertical Transportation (8-9)</i>		27.00	17
10.	Plumbing Systems	22.00	14
11.	Heating, Ventilating & Air Conditioning	38.00	24
12.	Electric Lighting, Power & Communications	28.00	18
13.	Fire Protection Systems	5.00	3
<i>Mechanical & Electrical (10-13)</i>		93.00	60
<i>Total Building Construction (1-13)</i>		251.00	161
14.	Site Preparation & Demolition		Excluded
15.	Site Paving, Structures & Landscaping		Excluded
16.	Utilities on Site		Excluded

<i>Total Site Construction (14-16)</i>		0.00	0
<i>TOTAL BUILDING & SITE (1-16)</i>		251.00	161
General Conditions	9.00%	23.00	15
Contractor's Overhead & Profit or Fee	4.00%	11.00	7
<i>RECOMMENDED BUDGET</i>		<i>March 2005</i>	285.00 182

Nursing Tower Typical Cost Model
 Double Patient Room

COMPONENT SUMMARY

		Gross Area, Double Room:	430 SF	
			\$/SF	\$x1,000
1.	Foundations		9.00	4
2.	Vertical Structure		18.00	8
3.	Floor & Roof Structures		27.00	12
4.	Exterior Cladding		35.00	15
5.	Roofing, Waterproofing & Skylights		6.00	3
<i>Shell (1-5)</i>			95.00	41
6.	Interior Partitions, Doors & Glazing		21.00	9
7.	Floor, Wall & Ceiling Finishes		15.00	6
<i>Interiors (6-7)</i>			36.00	15
8.	Function Equipment & Specialties		20.00	9
9.	Stairs & Vertical Transportation		7.00	3
<i>Equipment & Vertical Transportation (8-9)</i>			27.00	12
10.	Plumbing Systems		22.00	9
11.	Heating, Ventilating & Air Conditioning		38.00	16
12.	Electric Lighting, Power & Communications		28.00	12
13.	Fire Protection Systems		5.00	2
<i>Mechanical & Electrical (10-13)</i>			93.00	40
<i>Total Building Construction (1-13)</i>			251.00	108
14.	Site Preparation & Demolition			Excluded
15.	Site Paving, Structures &			Excluded

	Landscaping			Excluded
16.	Utilities on Site			
<i>Total Site Construction (14-16)</i>			0.00	0
<i>TOTAL BUILDING & SITE (1-16)</i>			251.00	108
	General Conditions	9.00%	22.00	10
	Contractor's Overhead & Profit or Fee	4.00%	12.00	5
<i>RECOMMENDED BUDGET</i>			<i>March 2005</i>	285.00 123

Pilot Study on Comparative Assessment of Patient Care Issues in Single and Multiple Occupancy Patient Rooms



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Introduction

This empirical component of this research documents analyzes and synthesizes information on the use, cost, efficiency and suitability of single and double occupancy patient rooms in specific hospitals. Our research team conducted cross-sectional surveys and semi-structured interviews in four hospitals in the Seattle area and in Oregon. These hospitals are:

Evergreen Hospital Medical Center (Seattle Area)

University of Washington Medical Center (Seattle Area)

Swedish Hospital Medical Center (Seattle Area)

Providence Health System (Oregon)

First costs of the single and double occupancy rooms in these hospitals are considered in the first cost analysis section. In this section we report on the findings of the survey conducted at the four hospitals. Data were collected from both the hospital administrative staff and the frontline staff (e.g., nurse managers, charge nurses, etc.). Data on hospital management, history, capacity, operational costs and patient care issues were collected from one administrative staff member in each hospital. Structured interviews were conducted with nurses and other health personnel taking care of patients in both single and double occupancy rooms. The variables examined in these interviews include: interaction with patients, patient contact hours, staff walking distances, ability to accommodate patients from different ethno-cultural groups, efficiency of medical procedures and patient's daily functioning, and advantages/disadvantages related to privacy and confidentiality (see Appendices VI and VII for examples of survey questionnaires).

Methods

Participants

Participants in this study included both administrative and nursing staff from three hospitals in Seattle, Washington, and one hospital in Oregon. In total, 77 respondents participated in the study (73 nursing staff members and four administrative staff members). The Seattle area hospitals were Evergreen Hospital, from which 14 nurses participated, Swedish hospital, from which 25 nurses participated, and University of Washington Hospital, from which 16 nurses participated. Providence Hospital participated from Oregon, with 18 nurses completing the

questionnaires. For each hospital, one administrative staff member also completed a questionnaire dealing with executive information.

Procedures

Participants were given short questionnaires, which took between 30 and 45 minutes to complete (questionnaires for the study are included in Appendices VI and VII). For the three Seattle area hospitals, researchers met with groups of nursing staff and were present while participants filled out the questionnaires. Respondents were told about the purpose of the study and were also given the opportunity to provide verbal feedback on their experiential evaluation regarding single- and double-occupancy rooms. Additional participants who were not able to complete the questionnaires in the allocated times were able to complete them on their own time and mail them back to the researchers.

Questionnaires were mailed out to participants at Providence Hospital in Oregon. Upon completion, the questionnaires were returned to the researchers. One representative from the administrative staff of each hospital was also solicited to fill out a short questionnaire. After the questionnaires were completed, they were sent back to the researchers. All the participants in this study were remunerated with a ten-dollar Starbucks gift card.

Measures

The nursing staff and administrative staff completed similar questionnaires, but the administrative questionnaire included additional questions pertaining to historical and operational information. This included the history of the hospital, the operating budget of the hospital, staffing information, and occupancy information. Administrative staff members were not required to fill out one portion of the questionnaire (dealing with the environmental characteristics of single- and double-occupancy rooms) that was filled out by nursing staff.

Demographic Information

Participants were asked to provide their gender and age. They were also asked to select their job designation from a variety of choices including nurse manager, charge nurse, nurse aide, clerk, and other. The participants were requested to specify the amount of time they had worked at their current hospital and the number of years experience they had in their profession.

Nursing Units

Four questions were asked pertaining to the nursing unit design. Nurses had to select the most common nursing unit layouts in their hospital and specify whether the units were centralized or decentralized. Choices included triangle, circular, linear, box, staggered, double loaded, and horseshoe design. The respondents were also able to draw out a design if they felt their layout was not represented in the choices provided. Questions also determined what type of medical/surgical unit the respondents worked on, the ratio of staff members to patients on the unit, and how many patients were assigned to the unit.

Patient Rooms

Various scales were used to measure the design of patient rooms. Respondents were asked to clarify whether they had experience working in both single- and double-occupancy rooms or solely in one type of room. Once this was established, respondents were asked eight questions, using a 5-point likert-type scale, regarding which type of room is more beneficial (See Appendix I). Choices included *single-occupancy rooms, double occupancy rooms, four-bed wards, same in all types of rooms, or don't know*. One question pertaining to the cleaning of rooms asked participants how often single- and double-occupancy rooms were cleaned and how long it took.

To address specific features of single- and double-occupancy rooms, 15 questions were asked using a 5-point likert-type scale, ranging from very low, low, moderate, high, and very high (See Appendix II). Items included aspects such as flexibility of room usage, probability of medication error, and quality of patient monitoring. To investigate environmental characteristics in single- and double-occupancy rooms, 19 questions were asked, using a scale ranging from helpful and somewhat helpful to somewhat problematic and problematic. Items included the layout of the room, storage space, and heating and cooling (See Appendix III). Space was also provided in the questionnaires for respondents to make qualitative comments qualifying their responses.

DESCRIPTION OF THE HOSPITALS

Evergreen Hospital Medical Center, Kirkland, Washington

Evergreen Hospital Medical Center was established in 1972. The oldest patient bed unit was constructed in 1972, and the newest in 2002. There are a total of five buildings in the main hospital complex, with a total square footage of 719,009. Approximately seven percent of square footage, or 52,202 square feet, is dedicated to patient care units. The total number of

acute care beds in this facility is 155; there are also an additional 13 pediatric beds in private rooms. Evergreen Hospital contains 125 single-occupancy rooms, 11 double-occupancy rooms, and two four-bed rooms in the medical/surgical units. Additionally, the obstetrics department holds 49 single-occupancy rooms. Acuity adaptable rooms are available at this hospital, and were built to further the growth of the facility and to offer flexibility to patients.

Swedish Medical Center, Seattle, Washington

Swedish Medical Center was established in 1910, when the oldest patient unit was constructed. The newest unit was constructed in 2000. There are five buildings in the main complex, with a total square footage of over one million. Approximately 13,000-18,000 square feet are allocated to patient care units. The hospital includes 697 acute care beds. In the medical/surgical unit, there are 152 single-occupancy rooms and 52 double-occupancy rooms. The cardiovascular unit contains 20 single-occupancy and 20 double-occupancy rooms. The hospital does have acuity adaptable rooms in certain areas, such as obstetrics, which are more family oriented.

University of Washington Medical Center, Seattle, Washington

The University of Washington Medical Center is a comprehensive medical care facility. It is rated among the top dozen medical centers in the United States. Number of beds is 450. Inpatient admission in 2002 was 16,517, and total operating expenses were more than \$436 million.

Providence Saint Vincent Hospital, Portland, Oregon

Providence Saint Vincent Hospital was established in 1971. The newest patient bed unit was constructed in 2003. The main hospital complex is made up of two buildings, of which 80 percent of the total square footage, or 182,000 square feet, is dedicated to patient care units (total square footage is 225,000 square feet). There are a total of 450 acute care beds in the facility, and all but four of the rooms on the medical/surgical units are single-occupancy. Obstetrics is another department that contains all single-occupancy rooms, while the cardiovascular department includes one double-occupancy room, with the rest being single-occupancy. Acuity adaptable rooms are available at Providence. According to the viewpoint of administration, these rooms were built because they offer greater flexibility. Patient satisfaction and occupancy rates are better in these rooms than in traditional models, and patient safety is increased, since there are fewer transfers.

In the following section information on the findings for the survey is presented. The sample size for this study is small, as it is a pilot project and the data is mainly experiential in nature (that is, based on the experiences of the health care personnel), and the findings should be interpreted within that context. The data are combined for the four hospitals in the following results section. (The comparative data for the four hospitals are provided in Appendix IV).

RESULTS

Demographic Information

A majority of the respondents (88 percent) were females. In terms of their age, most participants (89 percent) were between the ages of 26 and 55 years (see Table 1). One participant chose not to respond to the question pertaining to age. The respondents were mainly charge nurses, registered nurses and nurse managers. One respondent was a nurse’s aide. Several respondents did not state their job designation.

Demographic characteristics of respondents	Value
Gender	Female: 88 % Male: 12 %
Age	18-25 years: 4 % 26-35 years: 32 % 36-45 years: 34 % 46-55 years: 23 % 56-65 years: 6 %
Designation	Charge Nurses: 34 % Registered Nurses: 27% Nurse Managers: 25 % Nurse’s aide: 1 %

TABLE 1: Respondents’ demographic characteristics.

Nursing Unit

In addressing the layout of the nursing unit, approximately one-third of the respondents identified the triangle design as the most common unit design, followed by the inverted triangle, box, double loaded and linear respectively (see Figure 1).

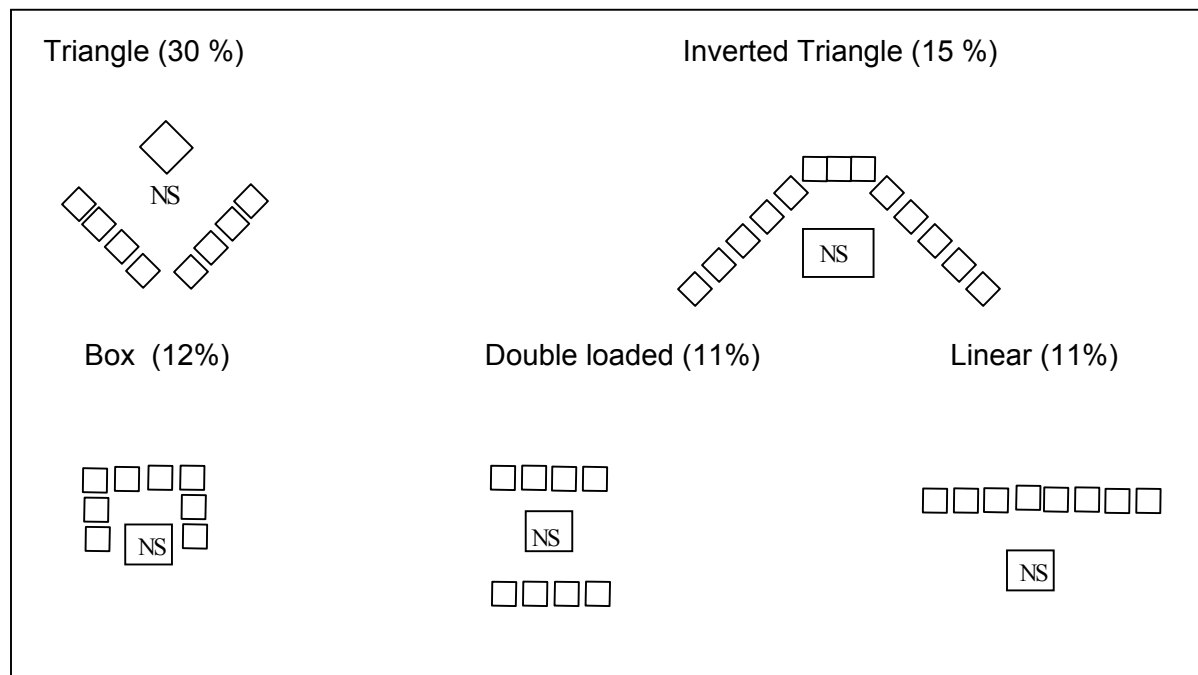


FIGURE 1: Nursing unit layout in study hospitals.

In hospitals with more than one type of layout, respondents identified the linear design as the second most common design. Other designs in this category include the box design and the circular design. When asked whether the nursing unit was centralized or decentralized, 38 percent of respondents stated their unit was decentralized, while 30 percent of nurses asserted their unit was centralized. Data were missing for 20 participants. Most nurses worked on an oncology unit (22 percent) or a telemetry unit (15 percent).

The number of patients per unit ranged between 5 and 30. Patient to staff ratios varied in different units. Throughout the day, patient to staff ratios ranged from 3:1 to 6:1, with 4:1 being the most frequent (30 percent). During the evening, patient to staff ratios ranged from 3:1 to 7:1, with 5:1 being the most common (27 percent). Overnight, the patient to staff ratios varied from 3:1 to 9:1. The most frequent ratio was 5-6 patients per staff member (38 percent).

Patient Rooms

Over three-fourth of the respondents (75 percent) had experience working in both single and multi-occupancy rooms and, in most cases, single-occupancy rooms were preferred over double

or multi-occupancy rooms. For instance, a large portion of respondents (86 percent) stated that fewer transfers occur in single-occupancy rooms (Figure 2).

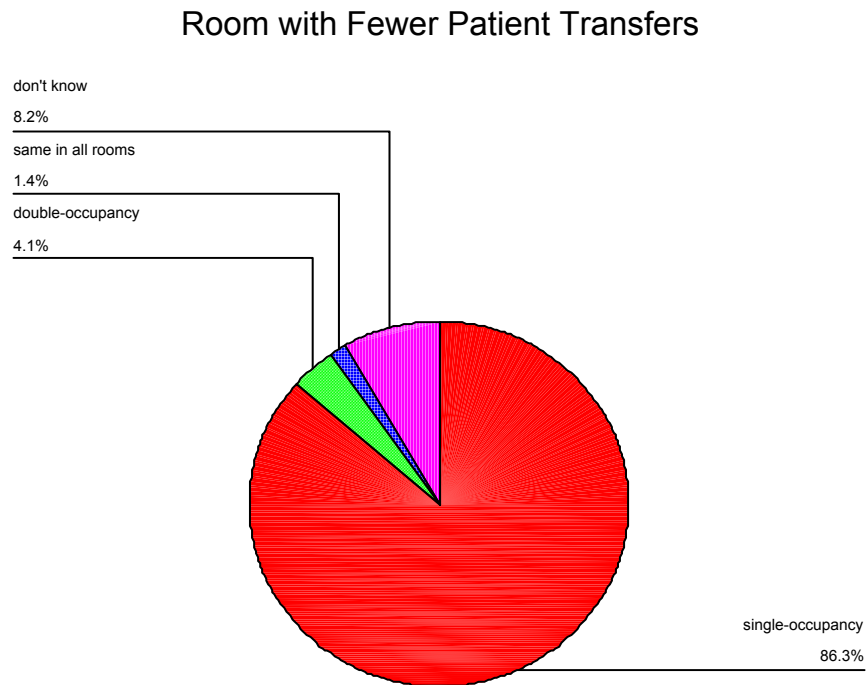


FIGURE 2: Comparison of rooms in terms of patient transfer.

Respondents also felt that single-occupancy rooms have better access to bathing facilities (93 percent), more space for storage and equipment (86 percent), and are better suited for different ethno-cultural groups and family members (96 percent) compared to double or multi-occupancy rooms (Figure 3).

Room Better Suited for Ethno-cultural Groups & Family

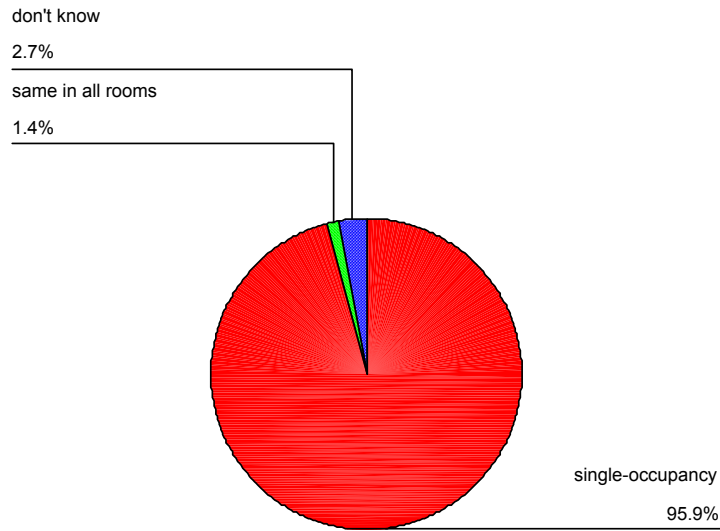


Figure 3: Comparison of rooms in terms of suitability for family and people from different ethno-cultural groups.

Staff efficiency is greater in single-occupancy rooms, according to more than half of the study participants (53 percent), and 58 percent of nurses noted that patients use less medication in single-occupancy rooms (Figure 4).

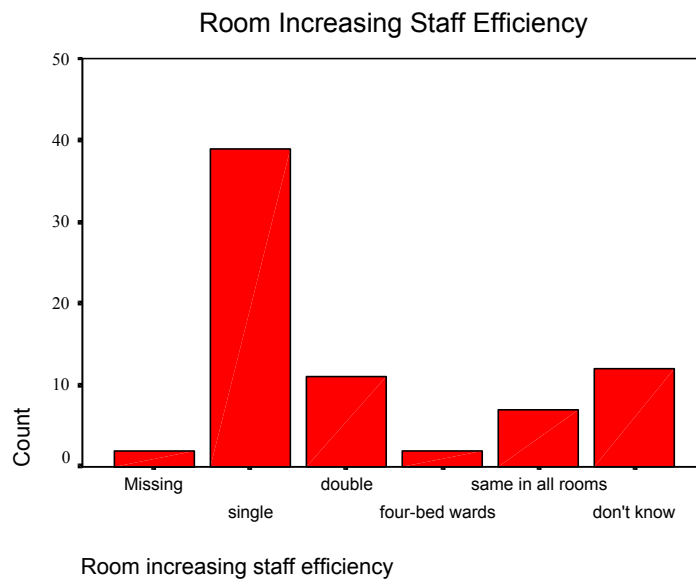


Figure 4: Comparison of rooms in terms of staff efficiency.

Approximately one-third of the respondents (30 percent) felt that walking distances are the same in single- and double-occupancy rooms and 4-bed wards, while 29 percent of nurses felt double-occupancy rooms required the least amount of walking by staff members (Figure 5). It seems that, in terms of the nurses' walking distance, the layout of the nursing unit, more than patient density in rooms, is a determining factor.

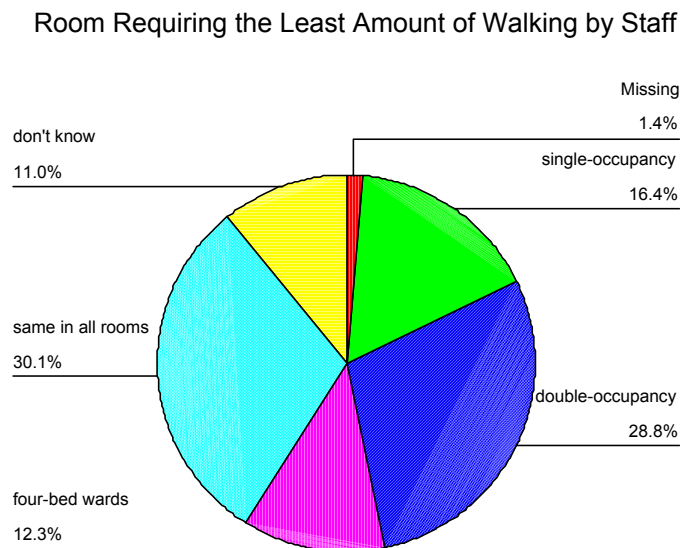


FIGURE 5: Comparison of rooms in terms of staff walking time

A little less than half (43 percent) of the respondents did not know the maintenance and upkeep costs of different types of patient rooms. However, approximately 23 percent of the respondents (out of a N=41) who knew about maintenance costs identified single-occupancy rooms as the least costly in terms of cleaning. Similarly, a significant percentage of respondents did not know the room cleaning frequency for patient rooms. Of those that did respond in the affirmative for this question, 63.0 percent (N=49) thought single-occupancy rooms are cleaned once daily, while 50.7 percent (N=40) of nurses stated that double-occupancy rooms are cleaned once daily. A small portion of nurses (four percent) stated that both types of rooms are cleaned twice daily.

The results were similar for the time taken to clean patient rooms. Around half of the respondents were unaware of the time it takes to clean the rooms, commenting that they are not responsible for the cleaning itself. Of those (N=39) who responded to the room cleaning time question, 26 percent stated that single-occupancy rooms require between 10 and 19 minutes to

clean. Twelve percent of those responding (N=29) stated that double-occupancy rooms are cleaned within 20 to 29 minutes, while 11 percent stated that it takes between 10 and 19 minutes to clean these rooms. Variation in times for room cleaning could be due to differences between regular or daily room cleaning and cleaning a room after a patient has been discharged. The latter takes longer as it is a more thorough cleaning. The findings on room cleaning frequency, time and cost are inconclusive as many of the respondents did not respond to this question. Nursing staff may not be the appropriate personnel to answer cleaning related questions. In future studies, janitorial or environmental maintenance staff should be interviewed to get more accurate information in this category.

Comparison of single- versus double- occupancy rooms

In comparing single- versus double-occupancy rooms, it is evident that nurses clearly favor single-occupancy rooms, as demonstrated by data in Table 2 and Table 3. Most of the participants responded to a majority of the categories in the comparison questions. However, there were a few categories where all the participants did not respond. Thus, the frequency (that is, the number of respondents) across the different categories is not the same. However, even with the missing responses the findings demonstrate that the nursing staff from all four hospitals prefer private rooms over multi-occupancy rooms. For instance, 84 percent of the respondents rated room flexibility as high or very high in single-occupancy rooms, whereas only 40 percent of nurses felt double-occupancy rooms are moderately flexible. In terms of flexibility in private rooms, one respondent stated that, “lots of room, private conversations in person and on phone, stay in room.” Interaction with family members and flexibility for accommodating family members both got high scores (high or very high) in private rooms, whereas in double-occupancy rooms, interaction with family members was considered low (33 percent) or moderate (47 percent) and flexibility for accommodating family members was considered low (48 percent).

Although interaction with family members is greater in single-occupancy rooms, interaction with other patients is greater in double-occupancy rooms. Specifically, 56 percent of the respondents stated that interaction was high in double-occupancy rooms, while 37 percent of nurses responded that interaction was low in single-occupancy rooms.

Item	Total N	Percentages					
		Very High	High	Moderate	Low	Very Low	Not Applicable
Flexibility of room usage	72	47.9	35.6	11.0	0.0	1.4	2.7
Scope for interaction among patients	68	12.3	13.7	13.7	37.0	13.7	2.7
Scope of interaction with family members and family participation in care	72	52.1	43.8	1.4	0.0	0.0	1.4
Flexibility for accommodating family	73	69.9	24.7	4.1	1.4	0.0	0.0
Suitability for patient examination	73	84.9	15.1	0.0	0.0	0.0	0.0
Quality of patient monitoring	73	37.0	45.2	15.1	0.0	0.0	2.7
Suitability for collection of patient history	73	82.2	17.8	0.0	0.0	0.0	0.0
Patient comfort level	73	68.5	31.5	0.0	0.0	0.0	0.0
Patient recovery rate	64	26.0	38.4	11.0	0.0	0.0	12.3
Scope for patient surveillance	71	20.5	37.0	31.5	4.1	2.7	1.4
Probability of medication error	73	6.8	2.7	13.7	42.5	31.5	2.7
Rate of nosocomial infection	69	6.8	4.1	13.7	47.9	19.2	2.7
Probability of dietary mix-up	73	8.2	2.7	9.6	54.8	24.7	0.0
Falls incidence	67	4.1	5.5	47.9	21.9	2.7	9.6
Rate of pain reduction /sleep inducing medication taken	66	13.7	11.0	37.0	21.9	0.0	6.8

TABLE 2: Features of Single-Occupancy Rooms

ITEM	Total N	Percentages					
		Very High	High	Moderate	Low	Very Low	Not Applicable
Flexibility of room usage	70	1.4	9.6	39.7	26.0	11.0	8.2
Scope for interaction among patients	70	5.5	56.2	19.2	11.0	0.0	4.1
Scope of interaction with family members and family participation in care	72	2.7	12.3	46.6	32.9	0.0	4.1
Flexibility for accommodating family	72	0.0	2.7	15.1	47.9	27.4	5.5
Suitability for patient examination	72	0.0	6.8	28.8	46.6	12.3	4.1
Quality of patient monitoring	71	1.4	26.0	57.5	6.8	0.0	5.5
Suitability for collection of patient history	72	0.0	1.4	27.4	45.2	20.5	4.1
Patient comfort level	71	0.0	1.4	34.2	38.4	19.2	4.1
Patient recovery rate	62	0.0	11.0	43.8	6.8	1.4	21.9
Scope for patient surveillance	71	1.4	20.5	52.1	16.4	0.0	6.8
Probability of medication error	71	11.0	28.8	39.7	8.2	2.7	6.8
Rate of nosocomial infection	66	9.6	35.6	30.1	5.5	1.4	8.2
Probability of dietary mix-up	71	8.2	34.2	35.6	13.7	1.4	4.1
Falls incidence	65	0.0	12.3	47.9	17.8	1.4	9.6
Rate of pain reduction /sleep inducing medication taken	64	4.1	31.5	32.9	6.8	2.7	9.6

TABLE 3: Features of Double-Occupancy Rooms

Single-occupancy rooms were chosen as most appropriate for patient examination (85 percent) and collection of a patient’s history (82 percent). However, less than half of the respondents rated double-occupancy rooms as low in their suitability for patient examination and collection of a patient’s history. According to one respondent, single rooms are more helpful as there is “more privacy, room for ambulation within room.” According to another respondent, “my opinion is that I am totally focused on one patient without interruptions [when noting patient history].” One respondent stated, “can’t assure confidentiality if there’s another patient in the same room.” Other factors such as the quality of patient monitoring, patient’s comfort level, patient’s recovery rate, and scope for patient surveillance were all rated higher in private rooms compared to double occupancy rooms. One respondent stated that “[patient recovery rate] could be impacted

by loss of sleep due to noisy/sick roommate.” On the issue of surveillance one respondent stated, “100% focus on 1 patient is better than one eye on one patient another eye on other patient.” Medication errors were considered low in single-occupancy rooms (43 percent) and moderate in double-occupancy rooms (40 percent). Double-occupancy rooms were selected in the high (34 percent) to moderate (36 percent) category for dietary mix-ups. Thus, the findings demonstrate that in both types of room there is little scope for medication error; however, double-occupancy rooms have a slightly greater chance of dietary mix-ups.

Fifty-seven percent of the respondents stated that the rate of acquiring a nosocomial infection is either low or very low in single-occupancy rooms (versus 10 percent respondents in case of double rooms), compared to 11 percent respondents stating that the rate is high or very high in single rooms (versus 46 percent stating the same for double rooms). The incidence of patient falls was considered moderate in both types of rooms (48 percent). Similarly, the rate of taking pain reducing or sleep inducing medicine was considered moderate in both types of room (37 percent in single occupancy rooms; 33 percent in double-occupancy rooms).

Environmental characteristics in single- and double-occupancy rooms

The respondents were asked to rate the environmental characteristics of single- and double-occupancy rooms based on their experiences at their present work setting (See Table 4 & Table 5). The respondents rated many of the environmental characteristics of single patient rooms as helpful. These included the layout of the room (47 percent), the availability of space in rooms (49 percent), the arrangement of furniture (47 percent), privacy (89 percent), and space for family members (51 percent). Double-occupancy rooms were thought to be somewhat helpful in terms of walking distance from the nursing station (41 percent) and visibility of the patients for monitoring purpose (40 percent).

ITEM	Total N	Percentages			
		Helpful	Somewhat Helpful	Somewhat Problematic	Problematic
Layout	68	46.6	23.3	16.4	4.1
Availability of space in room	72	49.3	27.4	11.0	9.6
Arrangement of furniture in room	71	46.6	21.9	23.3	4.1
Privacy	72	89.0	9.6	0.0	0.0
Walking distance from nursing station	68	16.4	27.4	41.1	6.8
Visibility	68	13.7	30.1	39.7	8.2
Degree of surveillance capability	70	17.8	31.5	39.7	5.5
Storage space for clean supplies	71	32.9	32.9	20.5	11.0
Storage space for dirty supplies	70	24.7	32.9	24.7	13.7
Location of storage area (clean & dirty)	70	19.2	41.1	24.7	9.6
Sink location	71	63.0	20.5	6.8	5.5
Bathroom location	71	65.8	21.9	4.1	2.7
Door location	71	67.1	19.2	9.6	0.0
Window location	71	72.6	21.9	2.7	0.0
Space for family members	72	50.7	21.9	20.5	2.7
Noise level/Acoustics	71	39.7	39.7	8.2	8.2
Lighting in space	71	53.4	28.8	12.3	2.7
Heating and cooling	72	47.9	21.9	20.5	8.2
Other = Bathroom size and wheelchair accessibility	1	1.4	0.0	0.0	0.0

TABLE 4: Environmental Characteristics in Single-Occupancy Rooms.

ITEM	Total N	Percentages			
		Helpful	Somewhat Helpful	Somewhat Problematic	Problematic
Layout	64	9.6	26.0	43.8	6.8
Availability of space in room	65	5.5	8.2	50.7	21.9
Arrangement of furniture in room	65	6.8	12.3	52.1	16.4
Privacy	65	2.7	1.4	28.8	56.2
Walking distance from nursing station	62	15.1	41.1	20.5	6.8
Visibility	64	6.8	39.7	34.2	5.5
Degree of surveillance capability	62	8.2	32.9	34.2	8.2
Storage space for clean supplies	64	5.5	9.6	58.9	13.7
Storage space for dirty supplies	64	4.1	15.1	49.3	19.2
Location of storage area (clean & dirty)	62	8.2	30.1	32.9	12.3
Sink location	64	13.7	34.2	28.8	9.6
Bathroom location	65	5.5	27.4	38.4	16.4
Door location	63	13.7	41.1	28.8	2.7
Window location	63	13.7	39.7	27.4	5.5
Space for family members	65	4.1	4.1	35.6	45.2
Noise level/Acoustics	65	2.7	2.7	35.6	47.9
Lighting in space	63	9.6	23.3	39.7	13.7
Heating and cooling	65	9.6	12.3	37.0	30.1
Other	0	0.0	0.0	0.0	0.0

TABLE 5: Environmental Characteristics in Double-Occupancy Rooms.

Surveillance of patients was considered somewhat problematic in both single- (40 percent) and double-occupancy rooms (34 percent). Storage for clean and dirty supplies was considered somewhat helpful in single-occupancy rooms (33 percent), but in double-occupancy rooms, storage was considered somewhat problematic (59 percent for clean supplies; 54 percent for dirty supplies).

The location of the sink, bathroom, door, and window in the single-occupancy rooms were all rated as helpful by a large majority of respondents (63 percent; 66 percent; 67 percent; and 73 percent respectively). Similarly, in double-occupancy rooms, the location of the sink, door, and window were considered somewhat helpful (34 percent; 41 percent; and 40 percent respectively). The bathroom location, on the other hand, was thought to be somewhat problematic (38 percent).

Data in Tables 5 and 6 demonstrate that lighting, temperature control, and noise levels were considered helpful in single-occupancy rooms, but these features were felt to be somewhat problematic or problematic in double-occupancy rooms.

Samples of open-ended comments comparing single- and multi-occupancy rooms:

University of Washington Medical Center

Single patient rooms are always preferred over double. There is almost no reason to transfer patients – critically ill, or dying patients don't have to be moved, single rooms can accommodate families.

Single occupancy rooms provide a more private and quiet environment for patient, which is very important when it comes to a patient's healing and well-being. I also believe patients are at much less risk of nosocomial infections, especially when they are sharing bathrooms & showers-this puts patients at a much greater risk of passing germs to one another.

For single rooms, some of the rooms are very far from the nurses' station.

Our private rooms are fairly quiet. They are not close to the nursing station so they aren't within hearing distance of people working. However, it's concerning not to see any rooms from the front desk.

Evergreen Hospital

Because one can only place patients of the same sex in a double occupancy room, patient placement can become somewhat problematic.

The benefit of private, long, and narrow patient rooms for family members. Rooms that have provision for family members need to have bathrooms with a shower, enough room for equipment storage, a sink by the door, and a window.

Universal care rooms can help reduce operational costs.

[Nursing units] that are in open areas and provide good visibility of registered nurses and of patients in their rooms can help to decrease operation cost.

If rooms are narrower and closer together, staff walking distances can also be reduced.

Swedish Medical Center

In my experience, the majority of patients don't want a lot of interaction with other patients. On the oncology floor, private rooms provide opportunities for families and friends to be at patient's bedside during time of need (not usually the case in double rooms).

About 80-90 percent of all patients admitted to double rooms really want a private room, so we are constantly shuffling people around.

I'm unable to tell you what impact being in a private room versus double rooms has on these things. We should be just as vigilant in either room.

I've listed most things as both helpful and problematic. On our unit it depends on where your room is in the floor layout. Some rooms are bigger, some are close to, others far away from the nursing station which impacts noise levels, etc.

The double rooms are big but here we have a pillar in one of the three rooms, which causes much frustration. Families love having more space but this works only if the other bed is not occupied.

One cannot ascertain privacy when two patients share a room, particularly pt information.

Maintaining clean linens & prevention of cross contamination is problematic in two shared area.

Noise level is aggravated with more people in room. Also consider differences in individual preferences relating to noise/lighting and heating.

Many of our private rooms are not the same with layout or square footage so some of these answers really depend on what room.

Providence health system

The bathrooms are challenging in all rooms.

Every time we place a patient in a double or triple room [there is request for transfer].

Every patient is so different and likes different things, especially, temperature of room, noise level, etc. Single rooms are the only way to go.

We have a high level of confused patients, which would make double occupancy rooms problematic.

Patients interact with other patients more in a double room.

The patients in our "high acuity rooms" have very little space when patient has equipment in room-such as ventilator, special chair, special beds, family cots, BSC, etc. A room with no equipment is just barely enough room for the bed, chair, and bedside table.

The double rooms have very limited space to move in and patients are ambulating in tight areas. If patient's share a bathroom-nurses have trouble monitoring outputs. Also- confidentiality is almost impossible when two patient's are in the same room. The double rooms can be very crowded and can increase the risk to fall due to the lack of space (equipment in small spaces).

We try not to use the double rooms unless we don't have any private rooms.

The data on environmental features in single and double room demonstrate that single rooms have more helpful features than multi-occupancy rooms. However, one must keep in mind that environmental features of particular patient rooms are tied to the room layout, size, design and nursing unit layout. Thus, the helpful or problematic aspects of environmental features may vary from hospital to hospital.

Conclusion

This empirical component of this project was a pilot study on nursing staff's comparative assessment of patient care issues between single and double-occupancy rooms. Participants represent various levels of nursing staff. The findings need to be viewed within the context of the limited sample size of this pilot study (Nursing staff N=73; Administrative staff N=4). In comparing single- versus double-occupancy rooms, it is evident that nurses clearly favor single-occupancy rooms. Most of the participants responded more favorably for single rooms than for double rooms on the majority of the fifteen categories in the comparison questions. The most noticeable categories of positive assessment for single rooms include: flexibility for accommodating family, suitability for examination of patients by health care personnel, patient comfort level, patient recovery rate, less probability of medication errors, and less probability of diet mix-ups (see Tables 2 and 3, Appendix IV for more detailed information).

The respondents rated many environmental characteristics of single patient rooms as helpful. These included the layout of the room (47 percent), the availability of space in rooms (49 percent), the arrangement of furniture (47 percent), privacy (89 percent), and space for family members (51 percent). Double-occupancy rooms were thought to be somewhat helpful in terms of walking distance from the nursing station (41 percent) and visibility of the patients for monitoring purposes (40 percent). Surveillance of patients was considered somewhat problematic in both single- (40 percent) and double-occupancy rooms (34 percent). Due to disproportionate missing data in the transfer related question section, we have not reported that data. Future studies may want to rely on multi-method data collection, such as observation and log entries, as well as respondent surveys, in order to gain more accurate information on the tasks, time and cost involved in patient transfer.

The primary objectives of this pilot study were to gather an experience-based assessment from hospital staff in regard to single versus double patient rooms and to examine the validity and

relevance of the two survey questionnaires. The results generally support the positive aspects of single rooms from a patient care perspective, as suggested by the literature. The limitations of this study include limited sample size and limited data on operating costs. Findings need to be interpreted with these limitations in mind. Future studies need to examine carefully the implications for operating costs of the positive assessments of patient care issues associated with single rooms. An in-depth case study approach using multiple methods (e.g., systematic observations, information from data logs, qualitative interviews) can provide more useful data in regard to the complex relationships among patient care issues, operating cost variables, patient outcomes, and staff efficiency, as well as subjective evaluations by patients and family members.

APPENDIX I

Which type of room has fewer patient transfers (for infection control and psycho-social needs)?

Which type of room provides better access to bathing and toilet facilities?

Which type of room enables staff to walk lesser distance per work shift or day?

Which type of room increases staff efficiency and productivity?

Which type of room provides more space for placement of equipment and for storage?

Which type of room is less costly for maintenance and upkeep?

Room cleaning cost (please complete for the types of rooms present in your facility)

Room cleaning frequency in a single-occupancy room

Approximate time taken to clean a single-occupancy room

Room cleaning frequency in a double-occupancy room

Approximate time taken to clean a double occupancy room

In which type of room do patients tend to use less pain and/or sleep medication?

Which type of rooms are better suited for people from different ethno-cultural groups and their family members?

APPENDIX II

Flexibility of room usage
Scope for interaction among patients
Scope of interaction with family members and family participation in care
Flexibility for accommodating family
Suitability for patient examination
Quality of patient monitoring
Suitability for collection of patient history
Patient comfort level (resting undisturbed, sleeping, etc.)
Patient recovery rate
Scope for patient surveillance
Probability of medication error
Rate of nosocomial infection
Probability of dietary mix-up
Falls incidence
Rate of pain reduction /sleep inducing medication taken

APPENDIX III

Layout

Availability of space in room

Arrangement of furniture in room

Privacy

Walking distance from nursing station

Visibility

Degree of surveillance capability

Storage space for clean supplies

Storage space for dirty supplies

Location of storage area (clean & dirty)

Sink location

Bathroom location

Door location

Window location

Space for family members

Noise level/Acoustics

Lighting in space

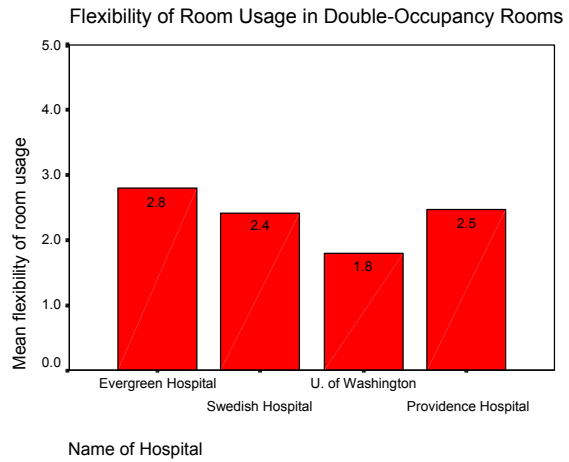
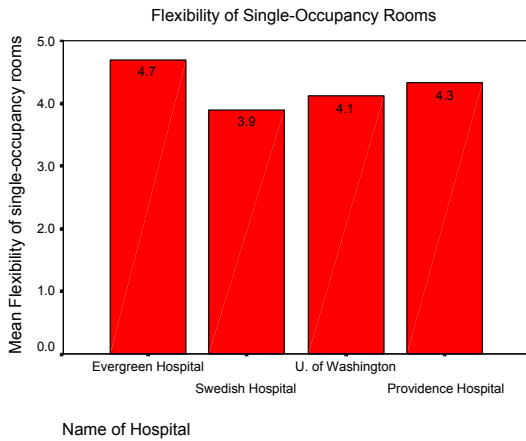
Heating and cooling

Other

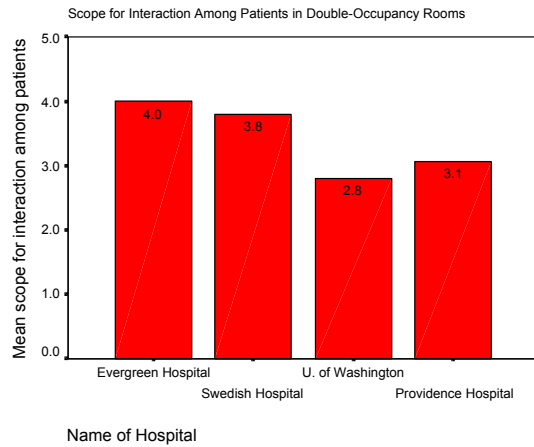
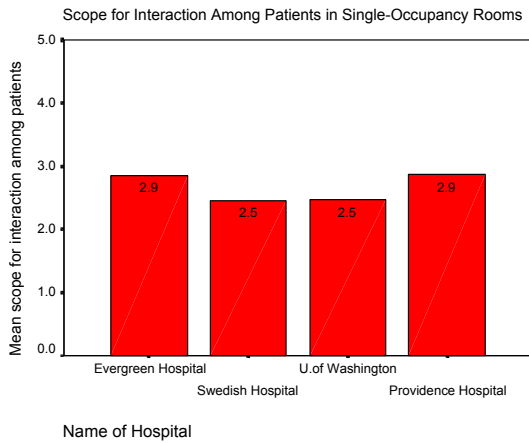
APPENDIX IV

Comparison of data across single and double occupancy rooms in four study hospitals
 To address specific features of single- and double-occupancy rooms, 15 questions were asked using a 5-point likert scale, ranging from very low, low, moderate, high, and high. The mean value for each of these variables (question) across the four hospitals (for both single and double occupancy patient rooms) is displayed in the graphs below. The graphs for both single and double occupancy rooms are displayed side-by-side for ease of comparison. These graphs demonstrate the consistency of findings across the four hospitals, as well as the findings for the combined data.

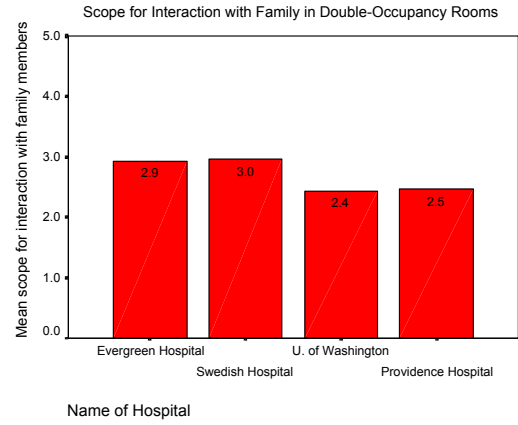
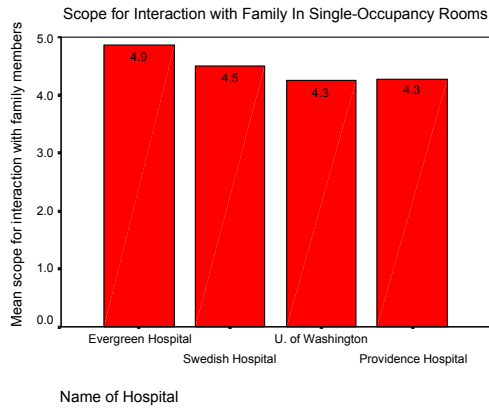
Flexibility of room usage



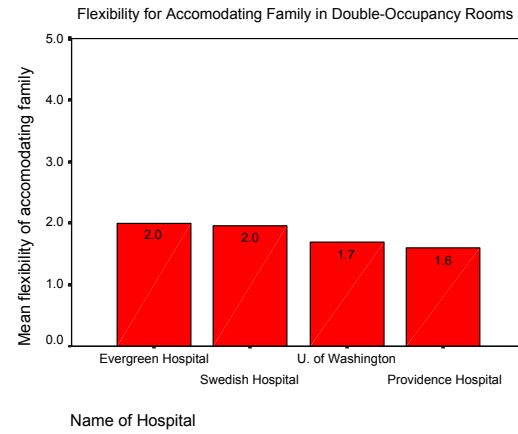
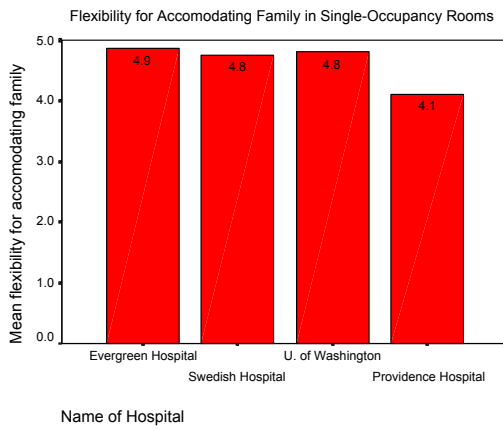
Scope of interaction among patients



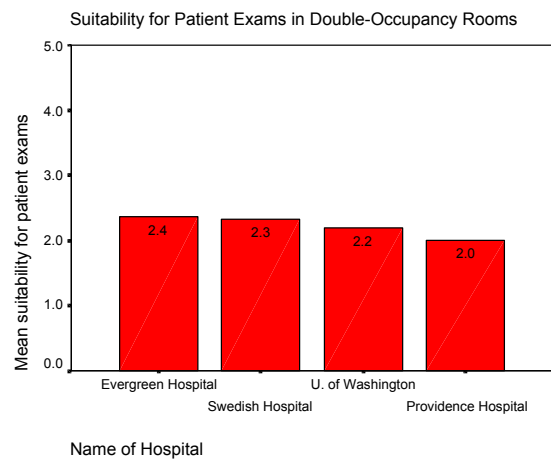
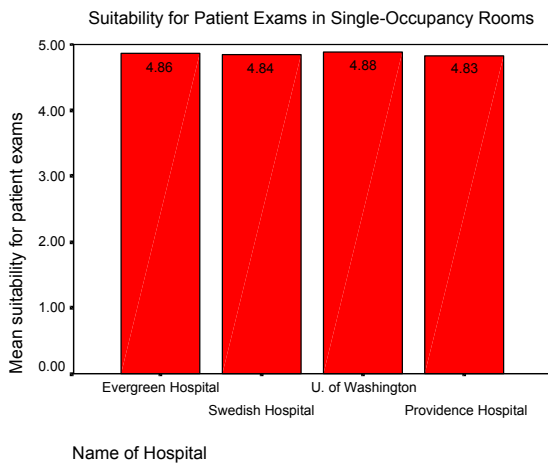
Scope of interaction with family



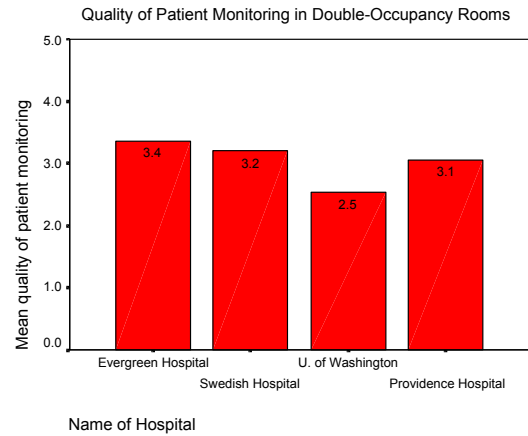
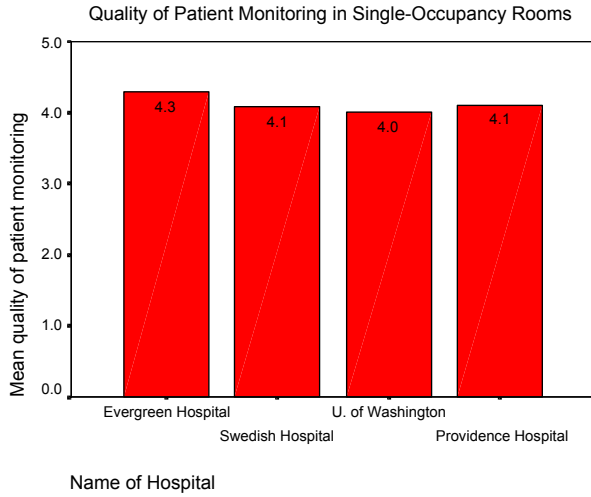
Flexibility for accommodating family



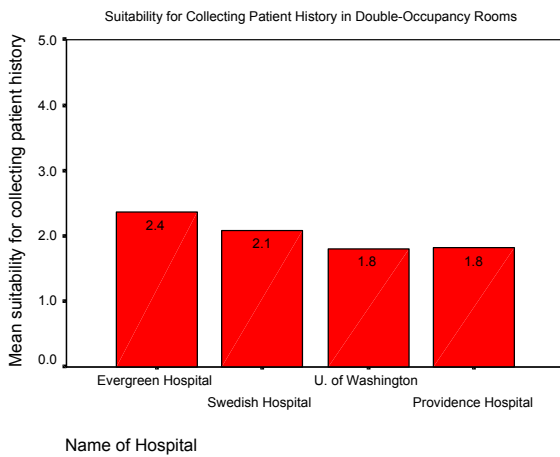
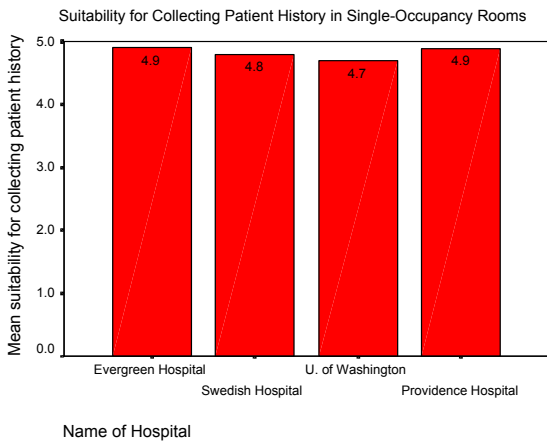
Suitability for examination of patients by health care personnel



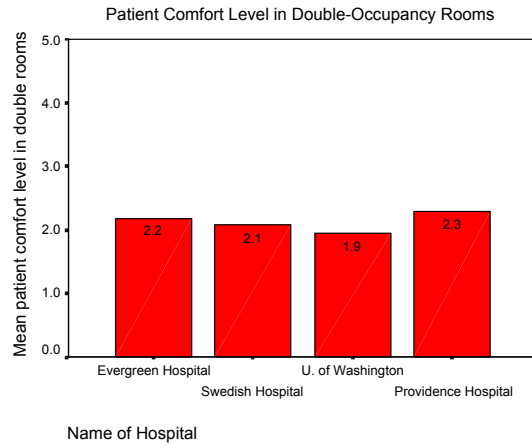
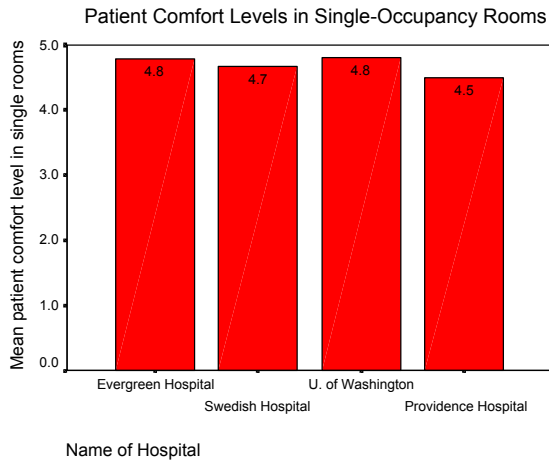
Quality of patient monitoring



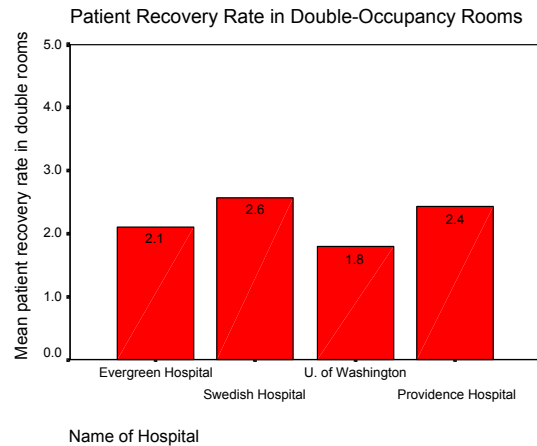
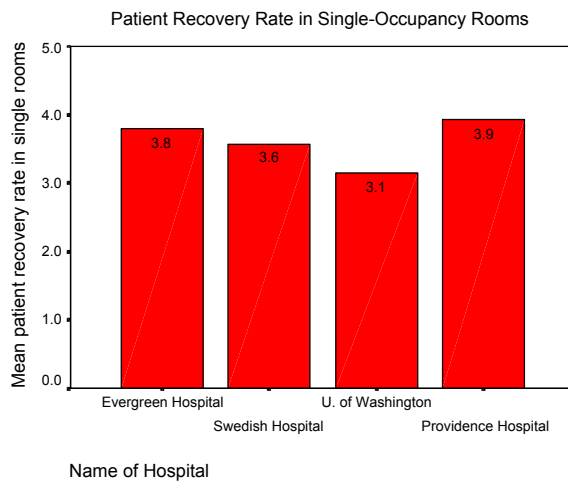
Suitability for collecting patient history by health care personnel



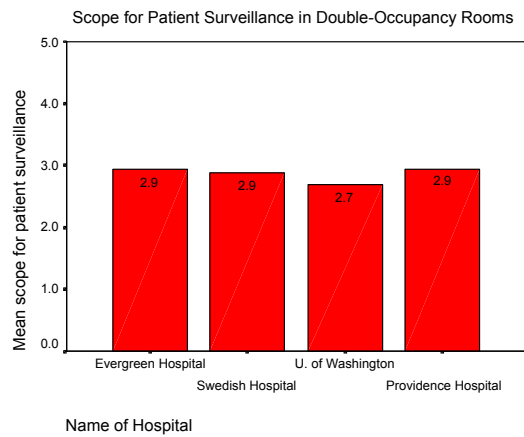
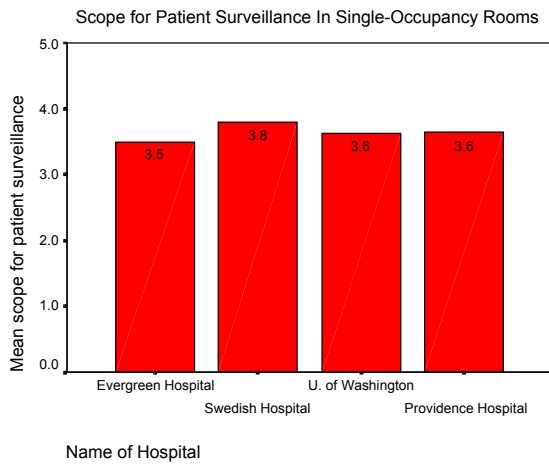
Patient comfort level



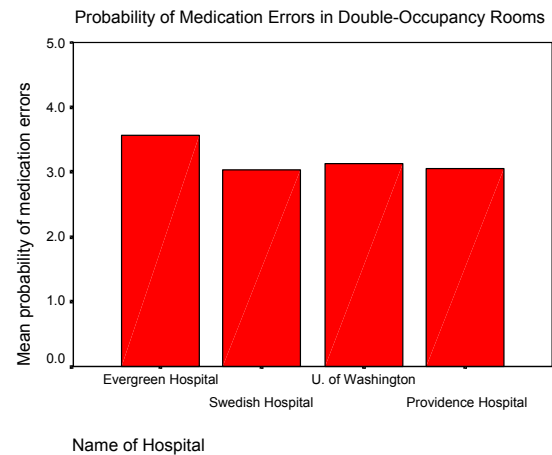
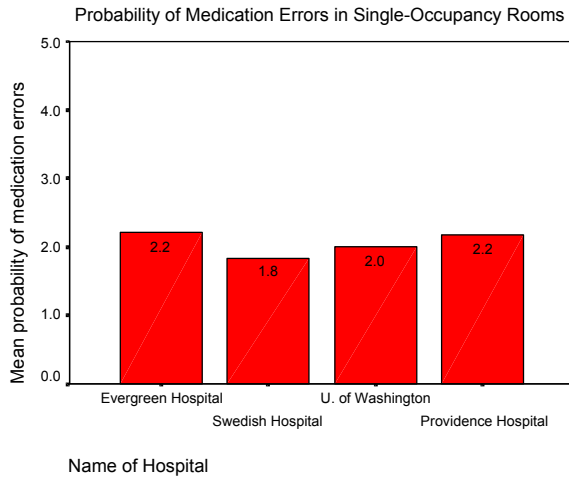
Patient recovery rate



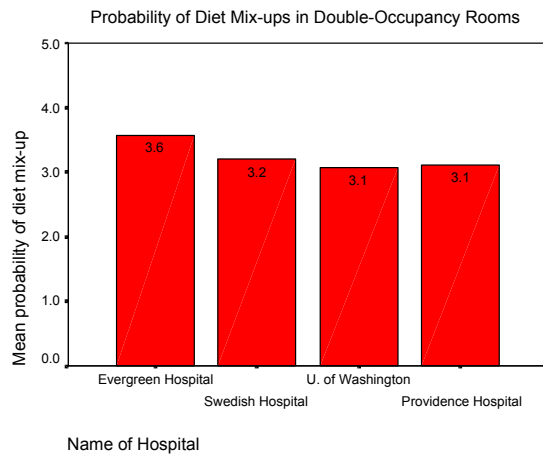
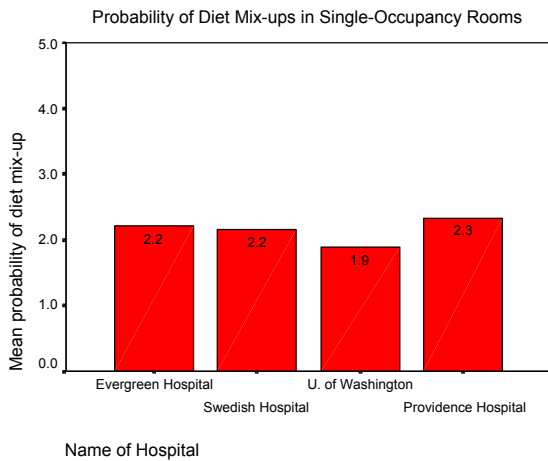
Scope for patient surveillance



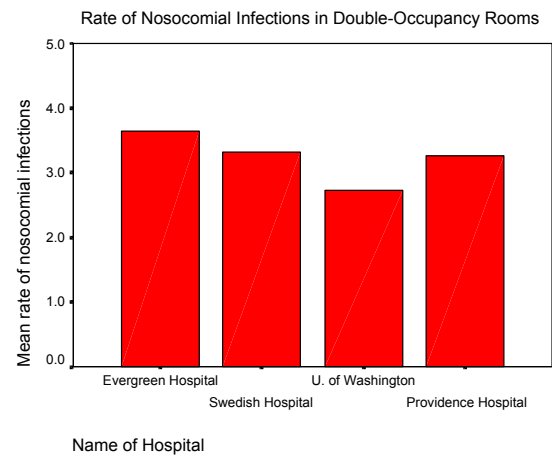
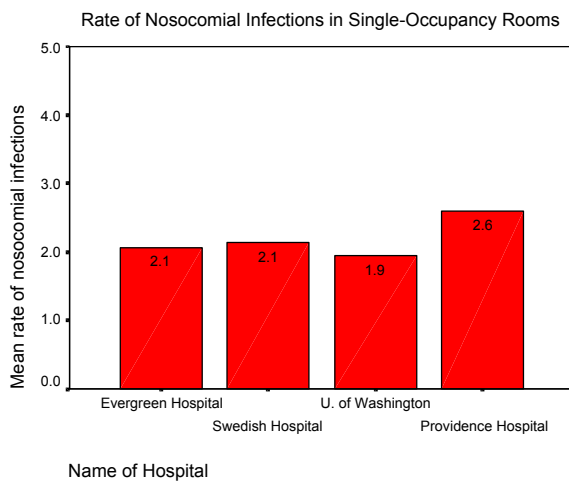
Probability of medication errors



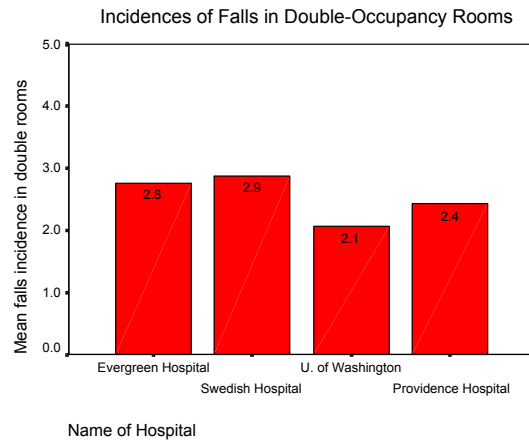
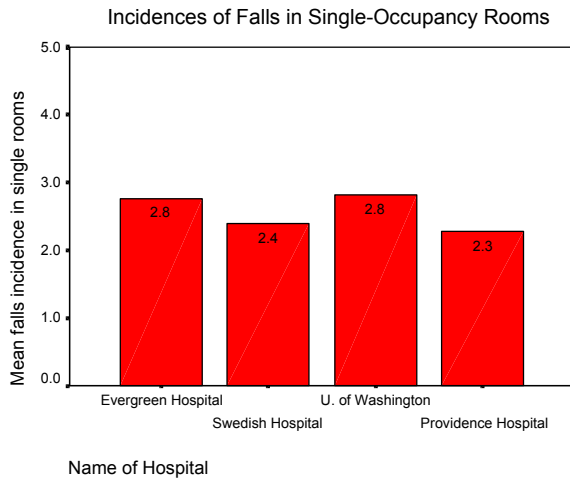
Probability of diet mix-ups



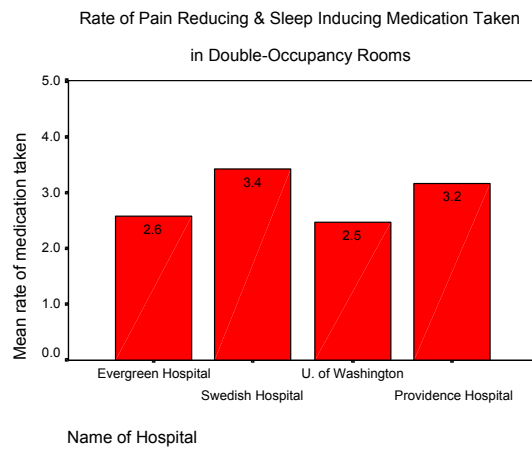
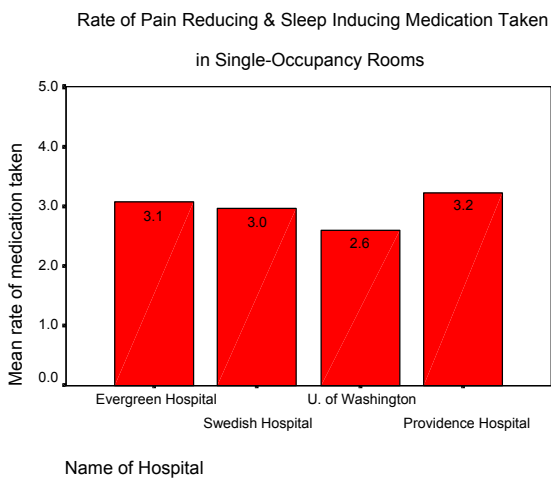
Rate of nosocomial infection



Falls incidence



Rate of pain reducing and sleep inducing medication taken



Empirical Articles

First and Operating Cost of Hospitals

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Ashby, J. L. Jr. & Lisk, C. K. (1992, Summer)</p>	<ul style="list-style-type: none"> ▪ To determine how general and medical inflation and intensity determine the hospital cost per case 	<ul style="list-style-type: none"> ▪ Conceptual model used which breaks down change in hospital operating costs per adjusted admission into seven components and four ratios 	<ul style="list-style-type: none"> ▪ Site & Sample: Data on FTE employees, admissions, total charges, and total operating expenses were obtained from the AHA annual hospital survey from 1985-1989 ▪ Patient complexity change measured using Prospective Payment Assessment Commission (ProPAC) methodology 	<ul style="list-style-type: none"> ▪ Largest single contribution to increase in hospital operating costs was inflation in the general economy; this accounted for 40% of average total increase ▪ Price inflation specific to hospital industry accounted for about 17% of annual increase in hospital expenses ▪ Patient complexity changes continue to be quite large and account for 21% of annual increase in costs per adjusted admission during analysis period ▪ 2% of total annual cost increase due to changes in quantity and quality of labor and non-labor inputs ▪ Although total operating costs increase rising during 1985-1989, portion of increase that partially subject to hospital control reduced ▪ Expenditures on supply upgrades decreased 	<ul style="list-style-type: none"> ▪ Cost controlling efforts should focus on controlling increases in intensity of services and lower wage and salary increases

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Berry, R. E. Jr. (1974, Summer)</p>	<ul style="list-style-type: none"> ▪ To identify and measure the effects of factors that significantly impact the cost and efficiency of short-term general hospitals in the U.S. 	<ul style="list-style-type: none"> ▪ Analysis of data utilized a model which measured hospital cost as a function of the level of output, the quality of services provided, the scope of services provided, factor prices, and relative efficiency 	<ul style="list-style-type: none"> ▪ Sample & Site: approximately 6000 short-term hospitals in the U.S for the years 1965, 1966, & 1967 	<ul style="list-style-type: none"> ▪ Hospital services are produced subject to decreasing costs initially and increasing costs eventually ▪ Average cost curves are ‘U’ shaped and shallow; magnitudes of the economies of scale are insignificant ▪ Empty beds lead to higher average costs for voluntary hospitals and lower average costs for proprietary and government hospitals ▪ Higher-quality hospital services cost more to produce than lower-quality services ▪ Costs are higher in hospitals that are involved in medical education ▪ More complex inpatient services and provision of community medical services are significant factors affecting hospital costs ▪ Differences in wages across hospitals explain significant part of differences in average costs across hospitals 	<ul style="list-style-type: none"> ▪ Several variables impact the costs incurred by hospitals ▪ No mention made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Cho, S., Ketefian, S., Barkauskas, V. H., & Smith, D. G. (2003, March/April)</p>	<ul style="list-style-type: none"> ▪ To examine the effects of nurse staffing on adverse events, morbidity, mortality, and medical costs 	<ul style="list-style-type: none"> ▪ 2 existing databases used to retrieve data: Hospital Financial Data and the State Inpatient Databases (SID) California-1997 ▪ Databases from three fiscal years (1996-1997, 1997-1998, and 1998-1999) were used to estimate nursing hours and patient days during 1997 ▪ Items measured were hospital characteristics, nurse staffing, patient characteristics, adverse events, morbidity and mortality, and costs ▪ Multilevel analyses were used to analyze the data 	<ul style="list-style-type: none"> ▪ Site: 232 acute care California hospitals ▪ Sample: 124,204 patients in 20 surgical diagnosis-related groups 	<ul style="list-style-type: none"> ▪ On average, patients were provided with 6.3 hours of RN staffing per patient day; total hours incurred by nurses per patient day was 8.9 ▪ Adverse events rarely occurred; patient characteristics such as age and sex were significantly related to adverse events ▪ Occurrence of adverse events related to longer length of stay; patient characteristics were related to longer length of stay but hospital characteristics were not related ▪ Adverse events associated with increased costs 	<ul style="list-style-type: none"> ▪ Having appropriate nurse staffing levels aids in the prevention of adverse events in hospitals; operational costs could then be reduced ▪ No mention made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Delon, G. L. & Smalley, H. E. (1970, April 1)</p>	<ul style="list-style-type: none"> ▪ To evaluate nursing unit designs in terms of traffic patterns and costs 	<ul style="list-style-type: none"> ▪ A list of existing inpatient nursing unit designs was compiled ▪ A representative collection of designs was selected and evaluated in terms of costs ▪ Designs evaluated were single-corridor, double-corridor, circular, and angular 	<ul style="list-style-type: none"> ▪ Site & Sample: U.S. hospitals 	<ul style="list-style-type: none"> ▪ Double-corridor designs are least costly followed by the circular design, single-corridor design, and angular design ▪ As the number of square feet per bed increases, construction costs rise, resulting in higher overall costs ▪ Private rooms increase traffic costs; multi-patient rooms tend to have fewer square feet per bed, reducing construction costs ▪ Smaller unit sizes result in shorter distances traveled, resulting in lower traffic costs ▪ Advantages of double-corridor designs include: patients are not likely to see into each other's rooms, the nurses' station is centrally located, & staffing patterns are easily divided ▪ Advantages of the single-corridor unit include: simple circulation patterns, good control from the nurses' station, & less space tied up in corridors ▪ Advantages of the circular unit include: centrally located nurses' station & shorter distances 	<ul style="list-style-type: none"> ▪ Unit design is more important than unit size in terms of evaluating the efficiency of the unit ▪ The double-corridor design appears to be the most efficient design ▪ Multiple-occupancy rooms appear to be more efficient than private rooms

				<p>between functional points; disadvantages include: higher construction costs, complicated patterns, limited size, & lack of control from the nurses' station</p> <ul style="list-style-type: none">▪ Advantages of the angular unit include: centrally located nurses' station & shorter distances between functional points; disadvantages include: most costly design, complicated patterns, & poor control from the nurses' station▪ Designs with compound circulation (double-corridor, circular) tend to be less costly than those with simple circulation (single-corridor, angular)	
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Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Dexter, F. & Macario, A. (2001, March)</p>	<ul style="list-style-type: none"> ▪ To describe how analyzing patient arrival and discharge data can help to determine the optimal number of staffed obstetrical beds to minimize labour costs 	<ul style="list-style-type: none"> ▪ Data was obtained from patients admitted and discharged from an obstetrical unit ▪ An average census was calculated and combined with the Poisson distribution, an optimal number of staffed beds needed was estimated 	<ul style="list-style-type: none"> ▪ Site: Stanford University Medical Center ▪ Sample: 777 successive patients cared for at the obstetrical unit 	<ul style="list-style-type: none"> ▪ The Poisson distribution fit the data for the weekdays and weekends 6 am to 6 pm and 6 pm to 6 am ▪ The amount of beds necessary are 15 staffed beds weekdays from 6 am to 6 pm, 12 staffed beds weekdays from 6 pm to 6 am, 12 staffed beds weekends 6 am to 6 pm and 10 staffed beds weekends from 6 pm to 6 am; these figures encompass a 5% risk that the hospital is willing to accept a patient without having enough staff to care for another patient 	<ul style="list-style-type: none"> ▪ Using statistical methods to determine the optimal number of staffed beds in an obstetrical unit can help a number of hospitals to keep the save money by not having excess staff ▪ No mention made in terms of room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Eastaugh, S. R. (2002, Fall)	<ul style="list-style-type: none"> ▪ To present results regarding factors that impact nurse productivity 	<ul style="list-style-type: none"> ▪ Nurse output data acquired from Atlas MediQual, the largest proprietary vendor of nurse workload and nurse scheduling systems ▪ Use of production function analysis to determine nurse productivity ▪ Five inputs studied: Nurse extenders (NE); registered nurses (RN); house-staff residents and interns performing some nursing activity; clerks, licensed practical nurses (LPN) and nurse aids; and capital ▪ Nursing output is specified by a point-scoring system 	<ul style="list-style-type: none"> ▪ Sample & Site: Data was collected for 37 hospitals in the U.S. between 1997-2000 	<ul style="list-style-type: none"> ▪ As RN labor becomes more costly, the labor of NE is used less extensively in place of RNs; NEs and RNs are complementary team members ▪ As house-staff labor becomes more costly, NE labor is used more extensively in place of residents ▪ In 2000, nursing departments were realizing only 81% of their technical efficiency ▪ Hospitals with the worst productivity employed no NE technicians and operated at 100% RN primary care nursing ▪ Hospitals with highest productivity made heavy use of NEs ▪ Shortage of nurses did not reduce productivity levels 	<ul style="list-style-type: none"> ▪ Primary care nursing is most productive when a combination of RNs and NEs is used as NEs help enhance productivity and reduce wasted labor

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Garattini, L., Giuliani, G., & Pagano, E. (1999)	<ul style="list-style-type: none"> ▪ To present a cost analysis method, which would enable an understanding of the distribution of resources among departments 	<ul style="list-style-type: none"> ▪ A step-down allocation was used to assess costs ▪ Department costs, wards and costs per stay for each ward were identified ▪ Costs were allocated based on the following categories: Overheads, direct costs, and indirect costs 	<ul style="list-style-type: none"> ▪ Site: Bolognini Hospital in Seriate, Italy ▪ Sample: 87,476 days of stay in the hospital 	<ul style="list-style-type: none"> ▪ 30 cost and revenue centers were identified ▪ Most expensive wards were the Intensive Cardio-Coronary Unit and ophthalmology; least expensive ward was general medicine ▪ Average bed day cost depends on the occupancy rate, the fixed costs inversely related to the number of hospital beds used ▪ Cardiology and pediatrics show highest variance for bed day costs 	<ul style="list-style-type: none"> ▪ No mention was made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Li, T. & Rosenman, R. (2001)	<ul style="list-style-type: none"> ▪ To use the stochastic frontier approach to analyze the cost efficiency of Washington hospitals 	<ul style="list-style-type: none"> ▪ Data was obtained from the year-end report of financial data and activities of the State Department of Health during 1988-1993 ▪ Outputs measured were total number of patient days and total number of outpatient visits ▪ Input prices used were labor, capital, and an aggregate of other costs ▪ Analyses were conducted using the stochastic frontier approach 	<ul style="list-style-type: none"> ▪ Site & Sample: 84 not-for profit hospitals and 6 for-profit hospitals in Washington State 	<ul style="list-style-type: none"> ▪ Not-for-profit hospitals are larger in terms of outputs and number of beds ▪ For-profit hospitals do greater share of inpatient business ▪ For profit hospitals pay less for most types of labor ▪ Capital and other costs were lower for not-for-profit hospitals ▪ Outpatient business increased for both types of hospitals, but the increase was greater for not-for profit hospitals ▪ Increases in costs and labor were twice as much at not-for-profit hospitals ▪ Hospitals with higher casemix indices or more beds are less efficient; severity of of iweciecys 	

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Morey, R. C., Fine, D. J., Loree, S. W., Retzlaff-Roberts, D. L., & Tsubakitani, S. (1992, August)</p>	<ul style="list-style-type: none"> ▪ To estimate the impact on hospital-wide costs if levels of quality of care are varied 	<ul style="list-style-type: none"> ▪ Quality of care was measured as a ratio of actual to risk-adjusted predicted inpatient mortalities in the hospital for a given year ▪ Nine aggregated hospital-specific measurements were used to measure service output ▪ Nine descriptors of the hospital environment and level of resource expenditures were used ▪ Cost estimates were based on costs expended by hospitals ▪ Information was extracted from the American Hospital Association regarding number of staffed beds, outpatient activity, and expenses on medical education 	<ul style="list-style-type: none"> ▪ Site & Sample: 300 hospitals drawn from CPHA database 	<ul style="list-style-type: none"> ▪ Hospital total cost highly correlated with number of beds and number of case-severity-weighted discharges ▪ Non-teaching hospitals were relatively efficient hospitals ▪ Larger hospitals had larger estimated marginal costs and larger average costs per death deferred ▪ Average additional cost for deferring one death is approximately \$29,000 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Thompson, J. D. & Goldin, G. (1975)	<ul style="list-style-type: none"> ▪ To determine the efficiency of various nursing unit plans 	<ul style="list-style-type: none"> ▪ Trips taken by nurses were used as the unit of measurement ▪ Traffic patterns were measured in four nursing units, two surgical units, and two medical units; one of each unit contained 30 beds and the other contained 48 beds ▪ Information was recorded by observers positioned at the nursing station ▪ Information included who made the trip, where the person left from and the destination of that person, and when the person went ▪ Data was collected over 15 shifts during a six-month period 	<ul style="list-style-type: none"> ▪ Site: Yale-New Haven Hospital, New York ▪ Sample: Nurses at Yale-New Haven Hospital 	<ul style="list-style-type: none"> ▪ Two variables, the distance between areas and the number of times this distance was crossed, were used to develop the Yale Traffic Index ▪ Redundant circulation schemes, such as the double-corridor, circular, and square plans were found to be more efficient, especially if the unit contained more than 30 beds ▪ The design of the inpatient unit is most critical factor in determining the unit's efficiency ▪ The size of the unit and the degree of privacy offered do not dictate the efficiency of the unit 	<ul style="list-style-type: none"> ▪ The efficiency of the unit is determined by the design of the inpatient unit ▪ Room occupancy is not related to the unit's efficiency

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Thompson, J. D. & Goldin, G. (1975)	<ul style="list-style-type: none"> ▪ To determine if occupancy rates are increased with all single-occupancy rates ▪ To determine if the increase in occupancy rates offsets the increased investment and operating costs of single-occupancy rooms 	<ul style="list-style-type: none"> ▪ Rooms were simulated using a computer program ▪ Groups of patients were generated based on characteristics such as sex, desire for a particular type of room, or need for a single-occupancy room ▪ Patients are then randomly admitted to the hospital and, if possible, to hospital beds; length of stay is used to determine occupancy rates ▪ The program was run to explore three different occupancy rates: 25,869, 29,465 and 33,172 patients and to account for various room occupancy levels 	<ul style="list-style-type: none"> ▪ Site & Sample: Computer simulations were used 	<ul style="list-style-type: none"> ▪ When all patients could be admitted in the five different room arrangements, the difference in average occupancy between arrangements that allowed 4.6% of single rooms to arrangements that enabled 100% single-occupancy rooms was only 0.37-0.39% ▪ On average, only 45 patients days would be gained in an all single-occupancy room unit ▪ An 80% occupancy level is ideal; less service failures occurred and most patients requesting admission were accommodated ▪ Operational costs appear lower in multiple-bed units 	<ul style="list-style-type: none"> ▪ The optimal mix of single- and multiple-occupancy rooms depends on medical, social, and economical factors ▪ It is recommended that a minimum of 25% of the beds should be single-occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Thompson, J. D. & Goldin, G. (1975)	<ul style="list-style-type: none"> ▪ To demonstrate that the size of the obstetrical unit affects the average occupancy of the unit ▪ To illustrate the effect that unit size has on investment and operational costs 	<ul style="list-style-type: none"> ▪ The hospitals were divided into 3 groups based on the number of obstetrical discharges ▪ Data was collected from the hospitals in terms of their discharge rate in the obstetrical unit ▪ Analyses were conducted to determine the impact that unit size has on operational costs 	<ul style="list-style-type: none"> ▪ Site: 33 Connecticut hospitals ▪ Sample: Obstetrical units in the hospitals 	<ul style="list-style-type: none"> ▪ Bed investment costs rise higher as admissions decrease; costs level off at 4,000 admissions ▪ Direct costs per day are higher for maternity suites serving small populations ▪ Swing units are an alternative if beds are needed for non-maternity patients; they can be made bigger or smaller based on the number of maternity patients; they require the separation of staff involved and of the ancillary areas 	<ul style="list-style-type: none"> ▪ No mention was made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Yafchak, R. (2000, Fall)	<ul style="list-style-type: none"> ▪ To determine whether or not large hospitals have lower long-run average costs per bed than small hospitals 	<ul style="list-style-type: none"> ▪ Data was extracted from the Medicare Cost Report from 1989-1997 ▪ Cross-sectional regressions were completed by year from 1989 to 1997 to assess the changes in the cost curve ▪ Unit of interest in the analyses was number of operating beds in the hospital ▪ A Cobb-Douglas production function was modified and used to incorporate case mix into the analyses 	<ul style="list-style-type: none"> ▪ Sample & Site: The primary data categories evaluated were non-profit versus for-profit hospitals and teaching versus non-teaching hospitals in the U. S. 	<ul style="list-style-type: none"> ▪ The average size of hospitals is relatively constant over time ▪ Average length of stay has decreased by 17% ▪ Shift towards more outpatient care; inpatient activity is more severe ▪ Revenue for hospitals is decreasing because units of service provided are decreasing ▪ High overhead costs incurred because occupancy is relatively low ▪ Profit margins are increasing ▪ Overall number of hospitals in the U. S. has declined by 18% from 1989-1997 ▪ Teaching hospitals are larger and serve sicker patients, have higher average revenues and costs, have more inpatient activity, and have slightly lower return on assets ▪ Larger hospitals have lower costs per bed; cost per bed higher in teaching hospitals 	<ul style="list-style-type: none"> ▪ Hospital revenues are declining as a shift is being made towards outpatient care ▪ No mention made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Zwanziger, J., Anderson, G. M., Haber, S.G., Thorpe, K. E., & Newhouse, J. P. (1993, Summer)</p>	<ul style="list-style-type: none"> ▪ To compare hospital spending in two U. S. states with spending in two Canadian provinces to better understand the differences in spending between the two countries 	<ul style="list-style-type: none"> ▪ Admission rates and average lengths-of-stay were calculated using hospital discharge data from each region ▪ Data was chosen for 1981 and 1985 ▪ Specialty hospitals were excluded 	<ul style="list-style-type: none"> ▪ Site: Hospitals in New York, California, Ontario, and British Columbia ▪ Sample: Patients admitted and discharged in the years 1981 and 1985 	<ul style="list-style-type: none"> ▪ Canadian hospitals, on average, provide far higher proportion of low-cost sub-acute days of care; U.S. hospitals provide far higher proportion of high-cost intensive care days ▪ Costs are higher in California and lowest in Canada for majority of inpatient outputs ▪ Canadian hospitals have lower unit costs because each output produced at a lower cost ▪ Rate of increase in unit costs is lower in Canadian hospitals than U.S. hospitals ▪ Canadian hospitals combine lower treatment intensity with longer patient stays ▪ Average incremental costs of an outpatient visit were essentially identical in 1985 	<ul style="list-style-type: none"> ▪ It appears that hospital costs are lower in Canada than in the U.S. ▪ No mention made in terms of room occupancy

Non Empirical Articles First and Operating Costs of Hospitals

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Anonymous (2003)	<ul style="list-style-type: none"> ▪ To describe characteristics of the top 100 hospitals in the U.S. 	<ul style="list-style-type: none"> ▪ Hospitals in the U.S. 	<ul style="list-style-type: none"> ▪ Hospitals that demonstrate superiority in quality and operational efficiency are also most profitable ▪ Teaching hospitals have the most complex mix of patients while small community hospitals have the least complex mix ▪ Benchmark hospitals had median total profit margin of 8.81% while peer hospitals had a margin of just 3.69% ▪ Between 1996 and 2000, peer hospitals saw an increase of 13% in their adjusted expenses, while the top 100 hospitals had an increase of only 4% ▪ Top hospitals had a case flow of 51.4 admissions per bed while peer hospitals had a case flow of 44.4 admissions per bed ▪ Top hospitals continued to increase salary and benefit packages and consistently spent more than peers on overhead costs ▪ Hospitals in the Northeast are emerging as leaders 	<ul style="list-style-type: none"> ▪ The top hospitals provide high quality care while reducing expenses ▪ No mention was made in terms of room occupancy

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Anonymous (2003, February)	<ul style="list-style-type: none"> ▪ To describe how hospitals are achieving greater operating efficiency 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Challenges faced by hospitals in 2003 are rising costs, declining payments, and increasing patient volumes, especially among the aging population ▪ Trend in U. S. hospitals is toward greater efficiency ▪ Hospitals with 150-299 beds had highest operating margin in second quarter of 2002 ▪ Average daily census has increased steadily since 1997 and costs per adjusted discharge have also risen 	<ul style="list-style-type: none"> ▪ It appears that hospitals in the U. S. are moving towards greater efficiency ▪ No mention made in regards to room occupancy
Anonymous (1981, November-December)	<ul style="list-style-type: none"> ▪ To discuss results from a study conducted by the accounting firm of Ernst & Whinney in regards to the assumption that excess hospital beds are costly 	<ul style="list-style-type: none"> ▪ 8 Acute hospitals in Orange County, California 	<ul style="list-style-type: none"> ▪ Extra or excess beds in hospitals are one of the least important factors contributing to rise in healthcare costs ▪ The total cost per bed is \$8.60 per patient day or 2% of total hospital costs ▪ Hospital utilization is growing and the number of excess beds are decreasing ▪ 100% occupancy in hospitals is impossible because of the handling of different patients with different needs and patient mix factors 	<ul style="list-style-type: none"> ▪ Excess beds do not contribute to rising hospital costs in Orange County ▪ No mention was made in regards to room occupancy

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Batchelor, G. J. & Esmond, T. H. Jr. (1989)	<ul style="list-style-type: none"> ▪ To demonstrate high quality care costs less than poor quality care 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Quality of patient care can be improved without increasing overall expenditures ▪ Hospital costs can be reduced by eliminating ineffective or unnecessary treatments ▪ Underutilized facilities should be closed; duplicated services should be reduced ▪ Over utilization of tests affects quality of care and treatment ▪ Patient-centered care focuses on time spent by workers talking to the patients, physical attractiveness of hospital rooms, physical comfort, and convenient parking facilities 	<ul style="list-style-type: none"> ▪ Meeting patient-related quality criteria saves hospitals money by reducing number of hours spent in dealing with patient complaints ▪ No direct reference was made in regards to room occupancy
Bennett, M. (2002, June)	<ul style="list-style-type: none"> ▪ To describe ways that can help healthcare leaders make non-routine decisions 	<ul style="list-style-type: none"> ▪ U.S. Hospitals 	<ul style="list-style-type: none"> ▪ Multiple non-routine decisions usually made within same time period making it difficult to determine the impact of any individual decision on financial performance ▪ Leaders making decisions should use cost analysis to make decisions regarding all possible options; goal is to show how financial results will differ for each alternative and make most viable decision 	<ul style="list-style-type: none"> ▪ Non-routine decisions may have large impacts on the financial resources of hospitals, and thus careful analysis should be conducted before making a decision ▪ No mention made in regards to room occupancy

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Benton, P. (1998, January-February)	<ul style="list-style-type: none"> ▪ To comment on the financial positions of Pennsylvania hospitals 	<ul style="list-style-type: none"> ▪ Hospitals in Pennsylvania 	<ul style="list-style-type: none"> ▪ Through collecting and reporting hospital financial and utilization data, 3 key areas of interest have emerged: timeliness, comparability, and flexibility ▪ To gain cooperation from all facilities, the ability to report the most current data available is important; gives incentive for hospitals to participate in reporting data ▪ Comparability enables comparisons between facilities with the same core business operating in the same geographic area ▪ Ability to be flexible enhances cooperation from hospitals and helps produce the best report possible 	<ul style="list-style-type: none"> ▪ No mention was made in relation to room occupancy
Cleverley, W. C. (2002, July)	<ul style="list-style-type: none"> ▪ To describe the Hospital Cost Index (HCI), an effective measure of cost efficiency in hospitals 	<ul style="list-style-type: none"> ▪ U.S. Hospitals 	<ul style="list-style-type: none"> ▪ The HCI weighs 2 measures: the Medicare cost per discharge (MCPD) adjusted for case mix and wage index and the Medicare cost per outpatient claim (MCPC) adjusted for relative-value unit and wage index ▪ The MCPD deals with inpatient costs ▪ The MCPC assesses costs of outpatient services ▪ Both measures have a disadvantage in that they are a measure of Medicaid patients, and the costs for non-Medicare patients are not reflected 	<ul style="list-style-type: none"> ▪ The HCI is a reliable measure of cost-efficiency in hospitals ▪ No mention made in regards to room occupancy

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Gardner, E. (1992, June 22)	<ul style="list-style-type: none"> ▪ To discuss how hospitals could save money by eliminating inefficiencies 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Hospitals waste 1/3rd of time overcoming organizational inefficiencies ▪ Hospitals could save as much as \$60 billion each year by streamlining organizations, redesigning jobs, and improving communication and cooperation among departments ▪ Hospitals, on average, spend \$53 on clerical and communication tasks and \$25 on administration for every \$100 spent on direct patient care; better-run hospitals spend \$21 to \$42 on clerical and communication costs and \$8 to \$15 on administrative costs for every \$100 spent on direct patient care ▪ Hospital employees suggest that almost 60% of time wasted came from unnecessary paperwork and poor communication between departments; another 20% of wasted time is due to inefficient methods of operating; remainder due to variety of factors such as outdated materials ▪ Eliminating clerical tasks not related to patient care could increase nurses' efficiency and productivity 	<ul style="list-style-type: none"> ▪ By reorganizing and eliminating unnecessary tasks as well as improving communicating between departments, hospitals could save a great deal of money ▪ No direct reference was made in regards to room occupancy

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Goe, S. (2002, June)	<ul style="list-style-type: none"> ▪ To discuss Scenario facility planning (SFP), a pre-design process that looks at planning managed care for the future 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Hospitals now receiving over 60% of revenue from outpatient care ▪ SFP is a pre-design process that brings managed care executives and hospital administrators together; engage in “what if“ thinking for the future ▪ Anticipate needs of future based on possible trends of the future, not on the trends of the past ▪ One goal is to ensure hospitals will have sufficient number of beds to meet future needs ▪ Trends of future: aging population, population growth, and cultural shifts; must also consider unpredictable factors such as major epidemics ▪ Uncertainty in government reimbursement for hospitals 	<ul style="list-style-type: none"> ▪ Hospital executives should base hospital plans on possible trends of the future rather than on past experiences ▪ No direct reference was made in regards to room occupancy

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Hoppszallern, S. (2003)	<ul style="list-style-type: none"> ▪ To describe the financial performance of hospitals 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Department performance varies by bed size; larger hospitals treat patients with higher acuity, longer stays, and greater resource consumption ▪ Tertiary care and teaching hospitals offer more complex and costly care ▪ Costs of inpatient nursing expenses higher ▪ Total margins declined for all hospitals in 2001; hospitals high in managed care outperforming counterparts in profitability measures 	<ul style="list-style-type: none"> ▪ No mention was made in relation to room occupancy
Kirtane, M. (1999, April)	<ul style="list-style-type: none"> ▪ To discuss why hospitals are losing money 	<ul style="list-style-type: none"> ▪ Hospitals in the U.S. 	<ul style="list-style-type: none"> ▪ Once financially strong hospitals are being downsized to reduce expenses ▪ In the early 1990's, hospitals had reduced their costs and became efficient ▪ Physicians and hospitals then tried to neutralize the dominance of the managed care industry by using the Integrated Delivery system (IDS) which combined a hospital network, a physician network, HMO's, home care services, and assisted living communities ▪ Productivity of physicians decreases and expenses increased; Balanced Budget Act of 1997 reduced Medicare reimbursement for hospital and home care services ▪ Majority of hospital-sponsored HMO's were terminated or sold 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy

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Komiske, B. K. (1995)	<ul style="list-style-type: none"> ▪ To describe the Cooperative Care Center in Providence, Rhode Island 	<ul style="list-style-type: none"> ▪ Cooperative Care Center, Providence, Rhode Island 	<ul style="list-style-type: none"> ▪ Mission of Cooperative Care Center is to provide high quality care in hospital where healthcare professionals join patient and care partner to treat and manage patient's illness; emphasis is on educating patient ▪ No nurse stations on patient floors ▪ Setting is home-like and care is high-quality and lower-cost ▪ Patients have to require inpatient care, must be mobile, and must have a care partner ▪ No charge for room and board of care partner ▪ Privacy is important; patient rooms are locked ▪ Cost to build: less than \$128/square foot ▪ Cost per room: \$380/night.; includes both patient and care partner; costs at other Rhode Island hospitals range from \$440 to \$630 for a private room 	<ul style="list-style-type: none"> ▪ Patients can receive care in a home-like setting for lower costs than other hospitals in Rhode Island, provided they have a care partner to aid in the treatment ▪ Rooms in this facility are private

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Moore, J. (1999, December)	<ul style="list-style-type: none"> ▪ To discuss shared occupancy and its costs for seniors 	<ul style="list-style-type: none"> ▪ Assisted living facilities in the U. S. 	<ul style="list-style-type: none"> ▪ Only about 25% of seniors can afford current monthly rate of \$2500 for assisted living (private rooms) ▪ Alternative is shared living arrangements for unrelated individuals ▪ Shared occupancy can reduce monthly service fee for resident from \$2500 to \$1650; shared occupancy monthly service fee likely to be 60% to 70% of private occupancy fee ▪ 3 types of designs: studio; a modified one-bedroom space so each resident has individual living and sleeping space; two-bedroom unit with 2 equivalent sleeping areas and larger shared living space ▪ Roommates must be compatible 	<ul style="list-style-type: none"> ▪ Shared occupancy can be less costly for seniors in assisted living facilities

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Morrissey, J. (1994, September 19)	<ul style="list-style-type: none"> ▪ To describe a non-traditional method of acute-care at Rhode Island Hospital 	<ul style="list-style-type: none"> ▪ Cooperative Care Center at Rhode Island Hospital, Providence, R.I. 	<ul style="list-style-type: none"> ▪ Acute-care hospitals are being asked to keep staffing levels under control while at the same time handling more complex cases and getting patients discharged faster ▪ Cooperative Care Center (74-bed facility) has eliminated traditional hospital structure from plan and provides acute care at 30% lower cost while providing education to patient to deal with life after discharge ▪ Uses family members and friends of patients to administer routine care of patient ▪ Predict that this type of care will lead to lower readmission rates, improved patient outcome, shorter length of stay, fewer medication errors and enhanced satisfaction scores ▪ Care Center built for \$13.3 million-1/3less than comparable facility built to traditional acute-care standards: mechanical systems simpler, no nursing stations required, oxygen supply provided to only 14 rooms, & overhead paging replaced by patient/partner beepers ▪ Cost per square foot is \$125; rooms equipped with hotel beds (\$300), not standard hospital beds (\$6000) ▪ Daily charge \$140 less than traditional care at Rhode Island Hospital 	<ul style="list-style-type: none"> ▪ By creating a hotel-like environment and including family and friends in acute patient care, hospitals can care for patients in a non-traditional manner and save money ▪ Patient rooms include beds for both the patient and care partner and thus are private rooms

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<p>Priselac, T. (2000, July 17)</p>	<ul style="list-style-type: none"> ▪ To discuss factors that need to be considered in funding healthcare systems in terms of mitigating losses suffered by the Balanced Budget Act of 1997 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Foundation for successful hospital begins with strategic, financial, and operational planning based on constant vigilance and ongoing reassessment <p>Factors that should be assessed are:</p> <ul style="list-style-type: none"> ▪ Quality improvement fundamental in attracting patients, physicians and best employees ▪ Program development/strategic review: hospitals must eliminate and/or modify recent and longstanding programs ▪ Marketing the hospital is essential ▪ Managed care: hospitals should develop contracting and pricing policies based on present needs and those of the future ▪ Effective treasury management can help in times of uncertainty resulting from shifts in public policy ▪ Fundraising is essential for not-for-profit hospitals ▪ Productivity/supply chain management: productivity management most important consideration ▪ Information and Internet technology enhance communication and data utilization 	<ul style="list-style-type: none"> ▪ In light of governmental policies, hospitals can take steps to manage their finances through ongoing evaluations of factors that influence their operation ▪ No direct reference was made in regards to room occupancy

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Smet, M. (2002)	<ul style="list-style-type: none"> ▪ To gain insight into the literature on cost structure of hospitals 	<ul style="list-style-type: none"> ▪ U.S. Hospitals 	<ul style="list-style-type: none"> ▪ Over 85% of all hospital costs are paid through 3rd party insurers; their reimbursement policies create cost-minimizing pressures on hospital management ▪ Hospitals don't operate at long-run efficient position because they over-invest in capacity and equipment ▪ Larger, more specialized hospitals may be more cost-effective ▪ Cost savings can be accomplished through reduction in length of stay; day costs account for 60-70% of a 7-day stay ▪ Hospitals with large part of staff under 45 years of age were more costly ▪ Hospital overhead costs are driven by volume, capacity, and complexity 	<ul style="list-style-type: none"> ▪ In general, hospitals over-invest in capital ▪ No mention was made in regards to room occupancy

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Solucient. (2003)	<ul style="list-style-type: none"> ▪ To discuss changing trends in healthcare demographics and its impact on hospital usage 	<ul style="list-style-type: none"> ▪ U. S. hospitals 	<ul style="list-style-type: none"> ▪ Inpatient volume will increase over next 25 years due to aging baby boom generation, increasing life expectancy, rising fertility rates, and continued immigration ▪ Rapid growth in inpatient changes will be due to projected 85% growth of senior population ▪ Bed demand will grow to 2 percent annually by 2012 ▪ Markets with highest levels of migration (South and West) or large baby boomer population (Midwest and Northeast) will experience greatest change ▪ Anticipated growth of inpatient care for seniors will place increasing financial burden on Medicare 	<ul style="list-style-type: none"> ▪ Inpatient volume will increase drastically over the next 25 years mainly because of aging baby boom generation ▪ No mention was made in relation to room occupancy
Terry, K. (2003, January 10)	<ul style="list-style-type: none"> ▪ To give perspective as to why health care costs are increasing 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ In 2001, hospital outpatient spending rose 16.3% and more than half the total growth in healthcare spending came from inpatient and outpatient expenditures ▪ Primary care doctors are not benefiting from rising inpatient expenditures but specialists are ▪ HMO profit margins close to zero for past few years ▪ Technology is increasing cost of care ▪ Hospital rates rose and use of services increased because of reduced authorization requirements for tests and the consolidation of hospitals into bigger systems ▪ Insurance costs continue to rise 	<ul style="list-style-type: none"> ▪ Hospitals and specialists are benefiting from the increase in inpatient and outpatient care while primary care physicians are not seeing any increase in wages ▪ No mention made in regards to room occupancy

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Thompson, J. D. & Goldin, G. (1975)	<ul style="list-style-type: none"> ▪ To discuss future trends in hospital planning, design, operation, and management 	<ul style="list-style-type: none"> ▪ All hospitals 	<ul style="list-style-type: none"> ▪ A shift should occur from thinking in terms of a progressive patient care hospital to planning a progressive patient-centered system ▪ Hospitalizations should be used to cure the patient and to educate the patient to prevent relapses; single-occupancy rooms are not beneficial because patients should be trained in groups ▪ Milieu therapy can be used to combine professional support and patient interaction; a better outcome is achieved with this system ▪ Two problems in hospitals are the increased costs of new programs and searching for an institution that is large enough to meet the needs of patients and communities ▪ To decrease hospital costs, patient stays can be decreased; inpatient days can be reduced through staff monitoring of the patient to determine whether it is necessary for the patient to remain in hospital; patients stays can also be reduced by promoting comprehensive care outside the hospital ▪ Increased hospital costs are due in part to newly discovered scientific technology; the machinery used and nursing skills applied are expensive 	<ul style="list-style-type: none"> ▪ Room occupancy was mentioned in terms of training patients to prevent relapses; multiple-occupancy rooms are preferred in this instance

Empirical Articles
Healthcare Facility Management and Hospital Design

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Delon, G. L. & Smalley, H. E. (1970, April 1)</p>	<ul style="list-style-type: none"> ▪ To develop methodology for evaluating nursing units 	<ul style="list-style-type: none"> ▪ Qualitative checklists were developed for nursing unit design ▪ The model was applied to existing nursing units to determine its usefulness ▪ Traffic costs and construction costs were measured as were controllable and uncontrollable costs 	<ul style="list-style-type: none"> ▪ Site & Sample: U.S. hospitals 	<ul style="list-style-type: none"> ▪ Seven areas within the nursing unit serve as the beginning and end points for the majority of trips made by nurses ▪ These areas include the nurse station, patient rooms, clean supply rooms, laundry, kitchen, bedpan rooms, and the elevator ▪ Ten areas account for 80% of the trips originating or destined for the nursing station: dietary department, surgical suite, central supply, radiology department, housekeeping, laboratory, laundry, pharmacy, emergency, and other nursing units ▪ Larger units with more beds are advantageous because better staffing patterns are achieved, the need for tall buildings is eliminated saving costs in elevators and plumbing, and the number of medicine units, linen rooms, and nursing stations needed is lower ▪ Smaller units are better for supervising patients ▪ Trend towards single-occupancy rooms in hospitals; advantages 	<ul style="list-style-type: none"> ▪ Although arguments are made in favor of both larger and smaller nursing units as well as single-occupancy rooms, neither design is clearly favored

				<p>are higher occupancy rates, improved patient care, greater flexibility of operation, and reduced possibility of cross-infection</p> <ul style="list-style-type: none"> ▪ Nursing stations should provide for a head nurse office, charting area, medication unit, and work space for the ward clerk 	
<p>Douglas, C., Steele, A., Todd, S., & Douglas, M. (2002, October 17)</p>	<ul style="list-style-type: none"> ▪ To investigate how hospital design helps patients recover 	<ul style="list-style-type: none"> ▪ Interviews conducted with and questionnaires sent to patients who had stayed in the hospital for more than 5 days ▪ Groups set up with people from the community and experts to discuss patient-centered environment 	<ul style="list-style-type: none"> ▪ Site: Salford Royal Hospitals ▪ Sample: 785 people who returned questionnaires and 50 inpatients who were interviewed; community group 	<ul style="list-style-type: none"> ▪ Community group suggested hospital should have good signage, good lighting, privacy for patients, reduced noise levels, temperature controls, access to natural environment, accommodation for visitors, and safety ▪ Those interviewed suggested enough space for privacy, welcoming environment, provisions for visitors, views of nature, and design that facilitates communication ▪ Questionnaires suggested that patients least satisfied with lack of privacy and mixed-sex wards; patients who stayed in single rooms and on small bays clustered around a nursing station were most satisfied ▪ Patients suggested more pleasing and welcoming environment 	<ul style="list-style-type: none"> ▪ Patients preferred single rooms or small bay wards clustered around a nursing station

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<p>Gadbois, C., Bourgeois, P., Goeh-Akue-Gad, M. M., Guillamine, J., & Urbain, M. A. (1992)</p>	<ul style="list-style-type: none"> ▪ To analyze the spatial and temporal organization of nurses' work in medical and surgical units of French hospitals 	<ul style="list-style-type: none"> ▪ Nursing activity was observed and recorded in terms of sequence of areas visited, tasks executed, reasons for travel, and times of entry and exit for each area ▪ Observations covered the whole working period of the day shift; data collection spread over 6 months 	<ul style="list-style-type: none"> ▪ Site: Private hospital in Paris ▪ Sample: Nurses in the medical and surgical units of the hospital 	<ul style="list-style-type: none"> ▪ Nursing activities are divided into several acts distributed through time and space ▪ Two thirds of activities on the medical and surgical wards lasted less than 2 minutes ▪ Large number of activities performed in rooms isolated ▪ Large number of work areas devoted to different activities on ward; includes patients' room, nurses' area, the corridor, and other specialized areas ▪ U-shaped layout made visibility of individuals difficult 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy

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Kirk (2002)	<ul style="list-style-type: none"> ▪ To look at hospice patients' preferences for single or shared bedrooms ▪ To investigate factors that might lead to a change in preference 	<ul style="list-style-type: none"> ▪ Structured interviews were conducted with 24 patients (12 in each of 2 hospices) in regards to their previous and current experiences of single and shared rooms 	<ul style="list-style-type: none"> ▪ Site: 2 hospices in Leeds ▪ Sample: 24 patients (12 in each hospice); 6 male and 6 female patients were interviewed from each hospice ▪ 3 men and 3 women occupied single rooms & the other patients occupied shared rooms ▪ 19 of the 24 patients had previously stayed in a single room; 23 patients had some experience in a shared room 	<ul style="list-style-type: none"> ▪ 18 patients preferred to be cared for in single rooms; 5 preferred shared rooms; 1 had no strong view <p>Reasons given for preference of single room:</p> <ul style="list-style-type: none"> ▪ Privacy ▪ Quiet ▪ Avoiding upsetting other patients ▪ Reduce embarrassment ▪ Improve quality of sleep ▪ Having family member stay <p>Reasons given for preference of shared room:</p> <ul style="list-style-type: none"> ▪ Company ▪ Able to share experiences 	<ul style="list-style-type: none"> ▪ The majority of patients preferred single rooms over shared rooms, especially if they had distressing symptoms ▪ Patients with previous experience in a single room were more likely to prefer a single room

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Pease, N. J. F. & Finlay, I. G. (2002)	<ul style="list-style-type: none"> ▪ To determine if patients and their family members prefer single or shared occupancy rooms on an oncology ward 	<ul style="list-style-type: none"> ▪ Questionnaires were given to patients and their next of kin to ascertain preference for place of care 	<ul style="list-style-type: none"> ▪ Site: 17-bed oncology ward in England ▪ Sample: 50 oncology patients that were consecutively admitted; 17 died during admission; 36 relatives of patients 	<ul style="list-style-type: none"> ▪ Only 20% of patients preferred a single room; 68% wanted to be in an open area; 12% stated no preference ▪ 28% of relatives preferred their relative to be in a single room ▪ Wishes of patients and relatives agreed in only 50% of the cases ▪ Main reason given for remaining in 4-bed bay was to avoid isolation 	<ul style="list-style-type: none"> ▪ Ward design on an oncology ward should include some single cubicles as well as open areas, as the majority of patients prefer to stay in multiple occupancy rooms
Reid, E. A. & Feeley, E. M. (1973, January)	<ul style="list-style-type: none"> ▪ To determine the perceptions of patients relating to factors involved in sharing a two-person room 	<ul style="list-style-type: none"> ▪ Questionnaires were mailed to patients who had recently been discharged from the hospital and who had stayed in a double-occupancy room ▪ Patients were asked background information and to rate their experiences with their roommates 	<ul style="list-style-type: none"> ▪ Site: Large community hospital in the U.S. ▪ Sample: 51 patients who stayed in a double-occupancy room 	<ul style="list-style-type: none"> ▪ Fewer than half of the patients surveyed would opt for a private room if given the choice ▪ Roommates were good to have someone to talk to and roommates could help each other ▪ Privacy was an issue and roommates with too many visitors were annoying; noise was also an annoying factor ▪ Ill roommates were undesirable as was a large age difference between roommates 	<ul style="list-style-type: none"> ▪ Overall, patients preferred a double-occupancy room to a single-occupancy room

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Shepley, M. M. (2002)	<ul style="list-style-type: none"> ▪ To provide data on behavioral issues associated with the design of neonatal intensive care units 	<ul style="list-style-type: none"> ▪ Multimethod approach was used involving behavioral mapping, interviews, questionnaires, and calibrated measures of walking, noise, and temperature 	<ul style="list-style-type: none"> ▪ Site: Predesign research was conducted on the existing neonatal intensive care unit; post occupancy evaluation was conducted in new facility ▪ Sample: Nursing staff on the units 	<ul style="list-style-type: none"> ▪ New unit is open and divided into bays of six baby stations each ▪ Nurses spent most time in active baby care, followed by walking, conversations, passive baby care, and charting ▪ Nurses spent more time working with babies on new unit ▪ New unit was perceived as comforting, clean, but less secure than previous unit ▪ Family-centered spaces were perceived as supportive 	<ul style="list-style-type: none"> ▪ For the most part, the new unit was rated positively; nurses were able to move at a greater velocity in the new unit and they spent more time with the infants
Trites, D. K., Galbraith, F. D. Jr., Sturdavant, M., & Leckwart, J. F. (1970, December)	<ul style="list-style-type: none"> ▪ To investigate the impact of radial, single-corridor, and double-corridor nursing unit designs on the activities and feelings of nurses working on these units 	<ul style="list-style-type: none"> ▪ 4 nursing units of radial design, single-corridor design, and double-corridor design were examined on day, evening, and night shifts ▪ Work sampling was used and questionnaires were given to staff members over 82 days 	<ul style="list-style-type: none"> ▪ Site: Rochester Methodist Hospital ▪ Sample: 590 staff members 	<ul style="list-style-type: none"> ▪ In terms of activities and their locations, radial design was best, followed by the double-corridor design; the single-corridor design was the worst ▪ Nurse absenteeism is greatest on the single-corridor design and lowest on radial design ▪ More accidents occur on single-corridor design ▪ Nurses preferred to work on the radial design 	<ul style="list-style-type: none"> ▪ The radial design was preferred as nurses spent less time in travel than those on the other units and spent more time with patients

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<p>Trites, D. K., Galbraith, F. D. Jr., & Leckwart, J. F. (1967, December)</p>	<ul style="list-style-type: none"> ▪ To investigate which design of nursing units, radial, single-corridor, or double-corridor, is most efficient 	<ul style="list-style-type: none"> ▪ 4 nursing units of radial design, single-corridor design, and double-corridor design were examined on day, evening, and night shifts; radial units had 1 private room; linear units had 4 to 10 private units ▪ Information on nursing staff activities was collected by randomized work sampling method ▪ Subjective feelings of nursing staff obtained from questionnaires completed by staff immediately before and after every shift 	<ul style="list-style-type: none"> ▪ Site: Rochester Methodist Hospital ▪ Sample: 590 staff members 	<ul style="list-style-type: none"> ▪ Radial design was superior to the other 2 designs on all shifts ▪ Nursing staff spent significantly less time walking on the radial units ▪ Average distance from the center of the radial nursing unit to the patient's bedside is 34 feet; in the double-corridor design the distance is 48 feet; on the single-corridor design the distance is 71 feet ▪ Preference by nurses for radial unit; less time spent traveling and more time spent with patients ▪ Fewer absences of staff and fewer accidents occurred on the radial unit ▪ Fewer complaints made by patients, relatives, and physicians on radial unit 	<ul style="list-style-type: none"> ▪ The radial design was preferred because nurses were able to spend more time with patients and less time traveling ▪ No reference was made in terms of room design and its impact on nursing efficiency

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Veatch, R. M. & Veatch, L. L. (1994, Winter)</p>	<ul style="list-style-type: none"> ▪ To present information regarding the impact that roommates have on one another 	<ul style="list-style-type: none"> ▪ Case study ▪ Patient was interviewed at home in regards to his experiences with hospital roommates 	<ul style="list-style-type: none"> ▪ Patient was a 72-year old man with metastasized cancer, a herniated diaphragm, trigeminal neuralgia, a partially paralyzed leg, and diverticulitis 	<ul style="list-style-type: none"> ▪ Quality of patient's care influenced by interactions with roommates ▪ Roommates created anxiety and confusion in terms of responsibility towards roommate ▪ Experiences of roommates aroused concerns in patient in regards to pain experience and medication ▪ Nurses should be made responsible for assessing impact of roommate assignment; should talk to patients and address their concerns 	<ul style="list-style-type: none"> ▪ If patients are in multiple-occupancy rooms, care should be taken in assigning them a roommate

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Whitehead, C. C., Polsky, R. H., Crookshank, C., & Fik, E.</p>	<ul style="list-style-type: none"> ▪ To describe and evaluate the redesign of a psychiatric unit which used a psychoenvironmental model 	<ul style="list-style-type: none"> ▪ Patients were moved from a ward which was shaped in a cross, with large open dormitories to a ward which breaks up the long corridor and adds flexibility to day room areas ▪ Patients behavior was observed on the original ward and then again eight weeks after moving to the redesigned ward using the Behavioral Environment Assessment Technique 	<ul style="list-style-type: none"> ▪ Site: 30-bed psychiatric facility ▪ Sample: Patients who were veterans 	<ul style="list-style-type: none"> ▪ In the old design, socially related behaviors occurred in the hallways and hall intersection; after the redesign, these behaviors were more common in the visiting room, cafeteria, and day room ▪ Increase in frequency of staff observed in the day room after the redesign ▪ Visiting area was used more often after the redesign ▪ Staff and patients responded positively to the changes; patients were more affected by the redesign than staff 	<ul style="list-style-type: none"> ▪ The subjective experience of patients was improved as was staff behavior after the ward was redesigned ▪ Rooms were in a dormitory

Non Empirical Studies: Healthcare Facility Management and Hospital Design

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Aldridge, E., Smith, L. D., & Sperling, L. A. (1991)	<ul style="list-style-type: none"> ▪ To describe the design of VIP suites in hospitals 	<ul style="list-style-type: none"> ▪ Camellia Pavilion at the University of Alabama Hospital 	<ul style="list-style-type: none"> ▪ Unit contains 20 beds ▪ Patient rooms are a minimum of 390 to 400 square feet; armoires conceal television and VCRs; computers are available; bathrooms consist of full baths with a tub and shower ▪ Patients able to use this facility are non-acute ▪ Ratio of nurses to patients is one to four ▪ Georgian style décor used for design ▪ Cost of staying in room is slightly greater than cost of semiprivate room 	<ul style="list-style-type: none"> ▪ The VIP suites consist of private rooms
Anonymous (2001, March)	<ul style="list-style-type: none"> ▪ To describe the features of a new six-story tower at United Medical Center in Cheyenne, Wyoming 	<ul style="list-style-type: none"> ▪ United Medical Center in Cheyenne, Wyoming 	<ul style="list-style-type: none"> ▪ Non-profit hospital with 195 beds ▪ Private patient rooms with clean, modern look and comfortable feel ▪ Patients able to control lights and blinds from the bed ▪ Sleeper sofa available for family members when staying overnight ▪ In-room nurses' station; provides a separate area for nurses and clinical staff to work so don't have to use the patient's private bathroom ▪ Use of easy-to-clean floor and wall coverings and curved surfaces for safety, ease of maintenance, and maneuvering of equipment 	<ul style="list-style-type: none"> ▪ Private rooms are used, although no financial or empirical reasons provided

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Anonymous (2000, March)	<ul style="list-style-type: none"> ▪ To discuss patient rooms of the future 	<ul style="list-style-type: none"> ▪ TriStar Health System’s Centennial Medical Center, Nashville 	<ul style="list-style-type: none"> ▪ Patient room of the future will be larger ▪ Rooms should be holistic in nature: flowing, curved surfaces, soothing colors, in-room nursing stations, and easy to clean floor and wall coverings should be used ▪ Rooms should actively promote healing and staff efficiency and should allow increased flexibility to adapt to technological innovations 	<ul style="list-style-type: none"> ▪ No mention made of preference for single or multiple room occupancy
Anonymous (2000, January)	<ul style="list-style-type: none"> ▪ To describe why 2 facilities are converting semi-private rooms into private rooms 	<ul style="list-style-type: none"> ▪ Northwestern Memorial Hospital, Chicago ▪ William Beaumont Hospital, Royal Oak, Michigan 	<p>Northwestern Memorial Hospital</p> <ul style="list-style-type: none"> ▪ Made decision to go with private rooms because determined that privacy was critical for patients’ physical comfort ▪ Rooms have a window seat with pull-out bed to accommodate overnight visitor <p>William Beaumont Hospital</p> <ul style="list-style-type: none"> ▪ 90% of the patients request private rooms <p>Benefits of private rooms:</p> <ul style="list-style-type: none"> ▪ Shortened lengths of stay ▪ Costs cut ▪ Reduce risk of hospital-acquired infection ▪ Lowered risk of medication errors ▪ Semi-private rooms typically have 10% lower occupancy rate than private rooms do 	<ul style="list-style-type: none"> ▪ Both hospitals prefer private rooms

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Anonymous (1998, October)	<ul style="list-style-type: none"> ▪ To describe the remodeling of the telemetry and intensive care units at Methodist Hospital 	<ul style="list-style-type: none"> ▪ Methodist Hospital, St. Louis Park, Minnesota 	<ul style="list-style-type: none"> ▪ Goal to improve working conditions and efficiency ▪ Number of private rooms increased; if demand for beds exceeds supply, patients are placed in and eight-bed swing area ▪ Central nursing station eliminated; alcoves spread along corridors and furnished with work surface, seating, storage, and lighting ▪ Infrared technology used to track staff when needed 	<ul style="list-style-type: none"> ▪ Number of private rooms increased and ability to accommodate patients increased as 8-bed unit available when needed
Anonymous (1991a)	<ul style="list-style-type: none"> ▪ To discuss how hospitals should be designed in the future 	<ul style="list-style-type: none"> ▪ Hospitals in England 	<ul style="list-style-type: none"> ▪ Design of departments can affect running and staffing needs ▪ Hospitals should be pleasing for patients ▪ Case for single rooms exists ▪ Case against single rooms: cost and difficulty of nursing supervision ▪ Argument made that open ward is best for supervision and more private than bays of four or six patients 	<ul style="list-style-type: none"> ▪ Single rooms are the norm in independent hospitals and private wings in the NHS, but they are costly in terms of building and staff, and supervision by nurses is difficult ▪ Open ward may be best for supervision
Anonymous (1991b)	<ul style="list-style-type: none"> ▪ To describe aspects of a patient-centered hospital 	<ul style="list-style-type: none"> ▪ Hospitals in England 	<ul style="list-style-type: none"> ▪ Trend is towards patient-focused hospitals where services are decentralized and brought nearer to the patient ▪ Decentralization requires appropriate equipment, appropriate staffing, and appropriate size unit ▪ Optimal size is about 130 beds ▪ Main costs are running costs and patient-focused hospitals are less expensive to build than traditional hospitals 	<ul style="list-style-type: none"> ▪ Patient-focused hospitals are a viable alternative to traditional hospitals ▪ No mention made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Anonymous (1971)	<ul style="list-style-type: none"> ▪ To describe a newly devised semi-private room that offers private space to both occupants 	<ul style="list-style-type: none"> ▪ Carlisle Hospital, Pa. 	<ul style="list-style-type: none"> ▪ Design makes it possible for 1 patient to converse with visitors without inconveniencing or disturbing roommate ▪ Staff able to provide treatment and services to 1 patient without disturbing the other patient ▪ Both patients have equal access to toilet & wardrobe facilities ▪ Both patients have equal access to view of outside through 2 windows in room ▪ Pillow speakers enable each patient to select and enjoy radio or television programs without creating distractions for other patient ▪ Standard fabric curtain used to separate patient areas ▪ Windows indented 6ft from building façade providing sun and weather protection ▪ Patient room is 351 sq feet ▪ Color schemes different for each patient room off the same corridor ▪ Rooms are carpeted ▪ Bright colors used throughout nursing units ▪ Nursing units designed with conventional structural system 	<ul style="list-style-type: none"> ▪ Through this design, semi-private rooms can offer the patient privacy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Bacon, A. S. (1920)	<ul style="list-style-type: none"> ▪ To describe the ward design of an efficient hospital 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Ideal efficient hospital serves people in moderate circumstances and gives them all the conveniences of the most exclusive institutions ▪ Maximum capacity of wards seldom reached because flexibility of beds is small due to gender differences and diseases that are epidemics ▪ Private rooms provide comfort and eliminate issues with bed assignment ▪ In private rooms, temperature can be adjusted for the patients, better examinations can be made, and visiting hours can be regulated based on the patient ▪ Private rooms allow hospitals to achieve maximum bed capacity ▪ Centralized control is needed as it provides a systematic system of checking up 	<ul style="list-style-type: none"> ▪ Private rooms are desired to maximize bed occupancy and to provide patients with a more comfortable environment
Baker, J. & Lamb, C.W. (1992)	<ul style="list-style-type: none"> ▪ To highlight the importance of managing the physical environment in hospitals ▪ To explore the role of physical environment in hospital marketing 	<ul style="list-style-type: none"> ▪ U.S Hospitals 	<ul style="list-style-type: none"> ▪ Four roles of hospital facilities: communication, contributions to psychological welfare of patient, contributions to overall service quality perceptions, & market segmentation, targeting, and positioning ▪ Appearance of patients' rooms conveys attitude and concern of hospital towards needs of patients 	<ul style="list-style-type: none"> ▪ Incorporating needs of physicians, staff, and patients into hospital design can improve staff morale and productivity and make stay less traumatic for patients ▪ No mention made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Barista, D. (2000, November)	<ul style="list-style-type: none"> To describe changes made to Baptist Memorial Hospital to make the environment more pleasant for patients 	<ul style="list-style-type: none"> Baptist Memorial Hospital, Collierville, Tennessee 	<ul style="list-style-type: none"> Larger, more accommodating patient rooms built; able to integrate equipment and house family members Changes made due to increased competition and changes in healthcare delivery Design based on medical mall concept; integrates departments into layout of retail mall; allows for smooth outpatient-traffic flow 	<ul style="list-style-type: none"> The design incorporates more private rooms that are large enough to accommodate family members as well as integrate necessary equipment
Bilchik, G. S. (2002, July-August)	<ul style="list-style-type: none"> To describe various facilities incorporating the pebble project which is trying to evaluate impacts of healthcare design 	<ul style="list-style-type: none"> Children's Hospital in San Diego Methodist Hospital/Clarian Health Partners in Indianapolis Bronson Methodist Hospital in Michigan Barbara Ann Karmanos Cancer Institute in Michigan 	<ul style="list-style-type: none"> Children's Hospital: building new convalescent care hospital to provide long-term care to permanently disabled children; design includes storage for wheelchair, private spaces outside patients' rooms, and enhance air ventilation Methodist Hospital/Clarian Health Partners: 56-bed cardiovascular critical care unit; private rooms used with patients in control of light and temperature Bronson Methodist Hospital: Private patient rooms used and access provided to nature; positive distractions used Barbara Ann Karmanos Cancer Institute: Medication rooms are larger with the focus placed on lighting and acoustics 	<ul style="list-style-type: none"> Rooms in most of these hospitals are private based on the needs of the patients
Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Bobrow, M. & Thomas, J. (2000)	<ul style="list-style-type: none"> To describe efficient designs of patient rooms and nursing units 	<ul style="list-style-type: none"> All Hospitals 	<ul style="list-style-type: none"> Patient room seen as place of sanctuary, privacy, and safety Nursing unit provides a family support system Primary goal of nursing unit design is to minimize the average distance as well as the 	<ul style="list-style-type: none"> Efficient hospital design includes clusters of single-occupancy patient rooms and nursing substations to serve these clusters

			<p>range of distance traveled by nurses</p> <ul style="list-style-type: none">▪ Efficient designs include groupings of concentric pods and use of bedside computers▪ Hospitals have progressively moved from open wards to double- and single-occupancy rooms▪ Advantages of single room: patient can rest undisturbed, the rooms can be used for isolation, medication errors are reduced, and patient transfers are reduced thereby reducing hospital costs▪ Occupancy of multi-bed rooms reaches an average of 80-85%; occupancy of single-occupancy rooms can reach 100% occupancy▪ Design should be flexible so room can be converted from general acute care to critical care▪ Patients prefer single-occupancy rooms because of the privacy offered, the ability to control the environment, and room for accommodating family members▪ Universal rooms are large enough to accommodate complex bedside treatments▪ Maximum utilization of patient beds can be achieved by creating generic patient units, providing patient beds that can be used for a range of acuity levels, and providing sufficient numbers of single and isolation patient beds to accommodate increasing patient acuity▪ Patient care units should be decentralized into smaller clusters which contain decentralized nursing substations, provide increased visibility of patient beds and	
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			<p>reduced congestion</p> <ul style="list-style-type: none">▪ Nurse server should be provided adjacent to or within patient rooms to provide immediate access▪ Traffic on the unit should be reduced through used of waiting areas, larger patient rooms, and holding areas adjacent to service elevators▪ Space should be provided on units for frequently utilized ancillary and support services <p>Each patient care floor should consist of two to three patient units; support that can be shared by all units on the floor should be provided</p>	
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Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
<p>Bobrow, M. & Thomas, J. (1994, November 21)</p>	<ul style="list-style-type: none"> ▪ To describe trends in designing hospitals 	<ul style="list-style-type: none"> ▪ U.S. hospitals 	<ul style="list-style-type: none"> ▪ Many hospitals need to redesign facilities to reflect requirements of changing market; environment needs to be less institutional and more consumer-friendly ▪ Multibed units will be replaced by larger patient rooms with fiber-optic capabilities and space to house equipment as well as family members ▪ Clusters of small nursing stations responsible for pods of four to eight beds; computerized patient records and tracking systems permit more efficient staffing in single room model ▪ Flexibility of private rooms outweigh costs; rooms more comfortable and have increased privacy 	<ul style="list-style-type: none"> ▪ Rooms of the future should be larger and should be single occupancy to increase patient comfort as well as increase privacy and accommodate family members
<p>Brown, P. & Taquino, L. T. (2001, June)</p>	<ul style="list-style-type: none"> ▪ To outline the design and outcomes of a neonatal intensive care design project 	<ul style="list-style-type: none"> ▪ Neonatal Intensive Care Unit at Children’s Hospital and Regional Medical Center, Seattle, Washington 	<ul style="list-style-type: none"> ▪ All rooms single occupancy; clusters arranged around central nursing station ▪ Variable lighting, decreased sound and individualizing patient spaces more easily achieved in single rooms ▪ Family-centered care enhanced in single occupancy rooms and privacy is increased 	<ul style="list-style-type: none"> ▪ Rooms on the neonatal intensive care unit are all private; design benefits patients, family members, and staff

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Brown, W. J. (1994)	<ul style="list-style-type: none"> ▪ To describe how a patient's space should be personalized 	<ul style="list-style-type: none"> ▪ U. S. Extended care facility 	<ul style="list-style-type: none"> ▪ Beds: Should be placed on opposite walls or direct both beds toward window in semi-private room ▪ Paint: Use variety of compatible colors and textures ▪ Emphasis wall: Adds color and visual interest ▪ Windows: Use blinds curtains to provide privacy ▪ Doors: Use compatible but contrasting color from walls ▪ Corridors: Give each corridor unique character to allow for visual differentiation; use single-color carpet ▪ Nurse's station: should invite interaction ▪ Sitting rooms: small groupings of chairs and sofas to encourage interaction ▪ Use of artwork, plants, and appropriate lighting 	<ul style="list-style-type: none"> ▪ Semi-private rooms can be designed to promote home-like environment; allows patient interaction while enabling each resident to have own unique space ▪ Renovations cost efficient (less than \$5000 to refurbish) ; enhance resident's quality of life; make facility more marketable

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Burmhal, B. (2000)	<ul style="list-style-type: none"> ▪ To describe trends in healthcare 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Healthcare trend is towards greater outpatient services ▪ Number of short-stay hospitals is increasing; offer from several hours of observation to 72-hour stays ▪ Hospitals more likely to build more critical care beds and to make rooms larger and more private due to increase in seriously ill inpatients ▪ Nursing stations are decentralized to make work more efficient ▪ Patient rooms are larger to accommodate family members 	<ul style="list-style-type: none"> ▪ Trend is towards larger private rooms to accommodate increasing number of seriously ill inpatients
Carpman, J. (1992)	<ul style="list-style-type: none"> ▪ To describe how research can aid in design strategies 	<ul style="list-style-type: none"> ▪ U.S. Hospitals 	<ul style="list-style-type: none"> ▪ Design seen as marketing tool that can attract or repel patients ▪ Design can have effect on patient and visitor well-being ▪ Design can help prevent illness and injury ▪ Spaces are needed for visitors to have some privacy and escape ▪ Universal design emphasizes independence, safety, and adaptability over time ▪ Design should be pragmatic, based on needs of the users, reviewed and evaluated 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Cawood, C. (1993)	<ul style="list-style-type: none"> ▪ To discuss nursing unit design 	<ul style="list-style-type: none"> ▪ Rochester Methodist Hospital, Rochester, MN ▪ Scott and White Hospital, 		

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Che, P. (2002)	<ul style="list-style-type: none"> ▪ To present results of a study conducted by Solucient on hospital needs in the U.S. 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Demand for beds projected to increase as much as 46% in the next 25 years ▪ Age of baby boom generation, increased life expectancy, rising fertility rates, & continued immigration likely to contribute growth in inpatient care ▪ Demand expected to grow fastest in Western & Southern states and more slowly in Midwestern and Northeastern regions 	<ul style="list-style-type: none"> ▪ No mention of preference for single or multiple room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Coile, R. Jr. (1997)	<ul style="list-style-type: none"> ▪ To discuss changes that are occurring in the healthcare industry 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Capital investment is shifting from inpatient care to ambulatory care and non-acute facilities ▪ Economic message of managing care, managing cost, and managing clinical efficiency ▪ Community health information networks will be universal 	<ul style="list-style-type: none"> ▪ Healthcare is shifting from inpatient care to continuum-care services ▪ No mention made in regards to room occupancy
Contemporary Longterm Care (1997, August)	<ul style="list-style-type: none"> ▪ To present the results of a survey conducted by the American Association of Retired Persons in regards to private and shared occupancy rooms 	<ul style="list-style-type: none"> ▪ Assisted living facilities in the U.S. 	<ul style="list-style-type: none"> ▪ 82% of people surveyed prefer a private room; 4% would rather share a room; 14% didn't know or didn't care ▪ Women and people from the western U.S. were most likely to want their own room 	<ul style="list-style-type: none"> ▪ Most people would prefer to stay in a private room in an assisted living facility
Cys, J. (1999, March 29)	<ul style="list-style-type: none"> ▪ To review design factors that can help improve patient outcome 	<ul style="list-style-type: none"> ▪ Hospitals in the U.S. 	<ul style="list-style-type: none"> ▪ Good environmental design in hospitals can improve patient outcomes ▪ Noise can elevate patients' blood pressure and heart rate and can result in sleep loss; carpeting can help reduce noise levels as can using varied ceiling heights ▪ Sunlight exposure can help reduce depression ▪ Nature scenes, outside spaces, plants, indoor atriums, and windows are positive distractions ▪ Beds in private rooms should be on an angle and face the outside ▪ Seniors walk better and faster on carpeted floors 	<ul style="list-style-type: none"> ▪ Environmental factors can impact the outcome of patients ▪ In private rooms, beds should be located on an angle and face the outside so that the patient does not have to view the corridor

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Downing, K. (2002)	<ul style="list-style-type: none"> ▪ To provide information on the Planetree organization 	<ul style="list-style-type: none"> ▪ Planetree based hospitals in the U.S. 	<ul style="list-style-type: none"> ▪ Since 1998, Planetree has established 40 new affiliates; in 1998, only 15 Planetree facilities existed ▪ Model includes architecture and design of rooms; double rooms set up to allow window views for both patients; soothing artwork on walls; shelves hold photographs; room controls installed by beds ▪ Planetree has tried to make affiliation cost-neutral 	<ul style="list-style-type: none"> ▪ Double-occupancy rooms mentioned, but no reason given for this preference

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Duffin, C. (2002, June 4)	<ul style="list-style-type: none"> ▪ To discuss the preference of architects for single occupancy patient rooms 	<ul style="list-style-type: none"> ▪ Hospitals in England 	<ul style="list-style-type: none"> ▪ Architects suggest that all rooms should be en suite single rooms monitored by nursing substations ▪ Patients would recover more quickly in own rooms because exposed to less noise, sleep better, and have greater privacy ▪ Patients would receive most treatments in their rooms; space around beds should be larger to accommodate equipment ▪ Monitoring of patients not difficult if rooms designed in clusters with glass fronts ▪ Physical barrier between patients helps prevent infection 	<ul style="list-style-type: none"> ▪ Recommendation is for single rooms because of benefits to patients
Edgman-Levitan, S. (1997)	<ul style="list-style-type: none"> ▪ To describe elements the Picker Institute found critical to patient satisfaction with care 	<ul style="list-style-type: none"> ▪ Picker Institute, Boston 	<ul style="list-style-type: none"> ▪ Mission is to promote quality assessment and improvement strategies to address needs and concerns of patients and family ▪ Patients want to be involved in decision-making process and want their cultural and religious views respected ▪ Most important for patients' overall satisfaction are physical comfort, information and education, and respect for patients' preferences ▪ Physical design should incorporate features such as wayfinding, emotional support, gardens and plants, private areas, music, physical comfort, and places for alternative therapies ▪ Education can be achieved through use of computers, patient learning centers, tape recorders, and space for family members 	<ul style="list-style-type: none"> ▪ Patients' satisfaction is dependent upon their level of physical comfort, the information and education received, and respect for the patients' preferences ▪ No mention made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Fishback, B. W. & Krewson, C. (1981, February 16)	<ul style="list-style-type: none"> ▪ To describe the design of Vanderbilt University Medical Center 	<ul style="list-style-type: none"> ▪ Vanderbilt University Medical Center, Nashville, Texas 	<ul style="list-style-type: none"> ▪ Patient rooms were painted off-white and floors were carpeted ▪ Layout modified octagonal; patient rooms located along periphery ▪ Nurse stations contained within service core 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy
Fisher, S. (1982)	<ul style="list-style-type: none"> ▪ To discuss the design of a nursing home 	<ul style="list-style-type: none"> ▪ Christian City Convalescent Center, Union City, Georgia 	<ul style="list-style-type: none"> ▪ Two frequent complaints of nurses in nursing homes are tired feet and the tendency of patients to gather around their work areas ▪ The Convalescent Center is square in structure and rooms are arranged around the perimeter ▪ Patient rooms are located on exterior walls; nurses can observe each bed without entering the room ▪ Design maximizes space use, increases the intensity of patient care, and feels less institutional ▪ Less walking is required to get anywhere in the building due to the compact design ▪ High morale and low turnover among registered nurses; partly due to decreased walking 	<ul style="list-style-type: none"> ▪ Compact design reduces amount of walking by nurses ▪ No mention made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
<p>Forman, A. D., Stoller, J. K. & Horsburgh, C. R. Jr. (1996, February 1)</p>	<ul style="list-style-type: none"> ▪ To comment on the article written by Horsburgh (1995) 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Forman: Medical economic pressures are influencing design; hospitals are spending money on extravagant design while cutting back staff; skilled and labor-intensive care most important ▪ Stoller: design should optimize coordination among health care providers; alcoves in hallways enable private conversations; horizontal spaces should encourage face-to-face interaction among health care providers ▪ Horsburgh: Health care providers should be included in the design to help prevent misguided expenditures in design 	<ul style="list-style-type: none"> ▪ No mention was made in regards to room occupancy
<p>Francis, S. (2002, March)</p>	<ul style="list-style-type: none"> ▪ To describe future trends in designing hospitals 	<ul style="list-style-type: none"> ▪ Hospitals in England 	<ul style="list-style-type: none"> ▪ Hospital design has addressed functional requirements for clinical practice but environment not comforting or inspiring ▪ Shift in emphasis to patient-centered care ▪ New buildings include healthy living centers, information kiosks, and social and advice centers; will accommodate multidisciplinary teams ▪ Distinctive characteristics created for public, social, and private spaces ▪ Design can reduce stress for staff and reduce anxiety for patients 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy though private spaces are recommended for consultations and treatments

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Fromhart, S. G. (1995)	<ul style="list-style-type: none"> ▪ To compare private versus shared rooms in long-term care facilities 	<ul style="list-style-type: none"> ▪ Schoellkopf Health Center, Niagara Falls, New York ▪ Beth Shalom Home of Eastern Virginia, Virginia Beach, Virginia ▪ Capital Senior Living, Dallas, Texas 	<p>New York:</p> <ul style="list-style-type: none"> ▪ Private rooms only ▪ No “roommate problems” ▪ Family members can visit freely and decorate loved one’s room ▪ Increased costs justified by improved quality of life <p>Virginia:</p> <ul style="list-style-type: none"> ▪ Single rooms are for private paying residents ▪ Until government funding improves, semi-private room cost-effective standard ▪ If given choice, almost all those in a nursing facility would choose private rooms <p>Texas:</p> <ul style="list-style-type: none"> ▪ Shared living arrangements cost-effective ▪ Alternative to facility is low cost 2 bedroom apartment-type situation; share common room and have separate walled bedrooms ▪ Smaller facilities can benefit from having fewer units to control costs 	<ul style="list-style-type: none"> ▪ In all 3 cases, it appears that privacy is key; most patients would prefer a private room over a shared room ▪ For cost-effective purposes, shared rooms are the norm

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Gallant, D. & Lanning, K. (2001)	<ul style="list-style-type: none"> ▪ To describe the design of an acuity-adaptable room 	<ul style="list-style-type: none"> ▪ U.S. Hospitals 	<ul style="list-style-type: none"> ▪ Acuity-adaptable room support complete range of care required by patients ▪ Rooms are private and must be large enough to support clinical care equipment, staff, procedures, and family members ▪ Bathroom should be located along exterior side of room 	<ul style="list-style-type: none"> ▪ Rooms are private and are adaptable based on the needs of the patients
Garber, K. (1999, February)	<ul style="list-style-type: none"> ▪ To describe revisions made by the Joint Commission (JCAHO) to its hospital accreditation manual 	<ul style="list-style-type: none"> ▪ Hospitals in the U. S. 	<ul style="list-style-type: none"> ▪ Hospitals should create welcoming environments that support patient dignity and raise awareness among staff ▪ Hospitals should use visual clues and signs to help people get around; can help reduce anxiety and increase attention span and treatment compliance ▪ Elements of nature such as flowers help brighten rooms and make patients feel better 	<ul style="list-style-type: none"> ▪ Hospitals should be patient-friendly ▪ No mention made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Gilpin, L. (1996)	<ul style="list-style-type: none"> ▪ To describe how healthcare is moving from the Industrial Age to the Information Age 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Goal of the Information Age is not information, but knowledge- the integration of information to create health ▪ Patients becoming partners and taking personal responsibility for their health and making decisions about the treatment process ▪ People (patients, families, and staff) will always be more important than information ▪ Planetree developed techniques to encourage creativity among healthcare providers and design professionals ▪ Social support needs to be encouraged ▪ The best use must be made of treatments and preventative care that requires less technology and expenses ▪ The opportunity for learning should be created ▪ Every person should feel valued and nurtured despite cultural and ethnic differences 	<ul style="list-style-type: none"> ▪ No mention of preference for single or multiple room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Glanville, R. (1996, November)	<ul style="list-style-type: none"> ▪ To describe the design of a Swedish hospital ward 	<ul style="list-style-type: none"> ▪ Norrtalje Sjukhus, Sweden 	<ul style="list-style-type: none"> ▪ Patients are encouraged to progress from a quiet and fairly private bed space through a series of areas that provide opportunities for social activity as part of the healing process ▪ 24 bed groups were designed, arranged in 3 subgroups of 8 ▪ Subgroups consist of a 3-bed room, a 2-bed room, and 3 single bed rooms; each has its own en suite bathroom facilities ▪ Folding screens are provided for each bed to give the patient privacy and each patient has a view from the bed ▪ Staff facilities are provided and staff are expected to take breaks while on the ward 	<ul style="list-style-type: none"> ▪ Though a variety of occupancy rooms are used, patients are given their own space to ensure they have privacy
Graven, S. N. (1997)	<ul style="list-style-type: none"> ▪ To describe design factors of neonatal intensive care units 	<ul style="list-style-type: none"> ▪ Neonatal Intensive Care Units 	<ul style="list-style-type: none"> ▪ Controlled lighting for all infants ▪ Noise levels should be kept low 	<ul style="list-style-type: none"> ▪ Environmental factors, such as light and noise, can be adapted to the infants' needs ▪ No mention made in regards to room occupancy
Hahn, J. E., Jones, M. R., & Waszkiewicz, M. (1995, March)	<ul style="list-style-type: none"> ▪ To discuss the renovations made to two semi-private rooms in a geriatric unit 	<ul style="list-style-type: none"> ▪ Geriatric Rehabilitation Unit in the Johnston R. Bowman Health Center for the Elderly at Rush-Presbyterian-St. Luke's Medical Center 	<ul style="list-style-type: none"> ▪ Primary functions of patient room are patient care, nursing care, medical treatment, and therapies; activities of daily living; examinations; socializing; sleeping; and cleaning and repair ▪ Rooms were modified to maximize diminishing visual abilities of elderly and to provide warm, homelike environment; closets were also reconfigured ▪ Surveys suggest that patient satisfaction has improved 	<ul style="list-style-type: none"> ▪ Semi-private patient rooms were successfully modified to create a more aesthetically pleasing environment for patients

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<p>Hendrich, A., Fay, J., Sorrells, A. (2002)</p>	<ul style="list-style-type: none"> ▪ To describe the design of the Critical Care Unit at Methodist Hospital 	<ul style="list-style-type: none"> ▪ Comprehensive Cardiac Critical Care Unit in Methodist Hospital of Clarian Health Partners in Indianapolis 	<ul style="list-style-type: none"> ▪ Based on data from a time-and-motion video study, it was noted that patients moved 3 to 6 times during their stay as their acuity levels changed; tasks performed by caregivers were duplicated & an increased error factor was introduced due to multiple caregivers; nurse traveled several miles each shift to find supplies ▪ Private room was created to support changing levels of acuity ▪ Rooms are 400 sq. feet designed with a family zone, a patient zone, & a caregiver zone ▪ Patients can control lighting, temperature, and privacy as condition improves ▪ Nursing stations are decentralized ▪ Unit-to-unit transfers have decreased by 90% and the overall number of patient days per bed has increased; decrease has also occurred in patient falls and medication errors 	<ul style="list-style-type: none"> ▪ The acuity adaptable rooms have helped improve clinical outcomes, cost and operational efficiency, and staff and patient satisfaction

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<p>Hewitt, T. & McFarlane, J. (1997, August)</p>	<ul style="list-style-type: none"> ▪ To describe the ward of Leeds General Infirmary (Phase One) 	<ul style="list-style-type: none"> ▪ Leeds General Infirmary, England 	<ul style="list-style-type: none"> ▪ Maximum ward size is 28 beds with four bedded bays being the maximum ▪ Each ward can accommodate both sexes and have exclusive use of a shower and a toilet ▪ Most wards have 4 single rooms and some of these have ensuite facilities ▪ Rooms incorporate large windows which are set at a low level to enable patients to see outside ▪ Incorporate a clean and dirty hold area on each floor to minimize congestion on corridors ▪ Day spaces smaller and more friendly 	<ul style="list-style-type: none"> ▪ The design incorporates both single and multiple bed rooms and no preference for either is suggested

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Hill-Rom	<ul style="list-style-type: none"> ▪ To describe the benefits of the acuity adaptable room 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Changing trends in healthcare with the aging patient population requiring higher acuity care ▪ Patients are transferred various times from emergency to critical care to the medical-surgical rooms ▪ Acuity adaptable rooms reduce the need for patient transfers; the patient can receive all the care needed in one room, regardless of acuity ▪ Room size is increased, the patient is visible from the corridor, and there is space to accommodate visitors ▪ Medication errors, patient falls, phlebitis, and procedural and lab problems are reduced ▪ Average length of stay is reduced 	<ul style="list-style-type: none"> ▪ The acuity adaptable room is single-occupancy and reduces the need for patient transfers

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Hohenstein, J. (December, 2001)	<ul style="list-style-type: none"> ▪ To describe the successful construction of Children’s Hospital in Omaha, Nebraska 	<ul style="list-style-type: none"> ▪ Children’s Hospital, Omaha, Nebraska 	<ul style="list-style-type: none"> ▪ Colors used are inviting and uplifting (colors used on the exterior are peach, beige, and gray brick) ▪ 130-bed facility ▪ On each floor, the themes are drawn from the environment of Nebraska ▪ Diversion and entertainment important: game rooms on every patient floor, artwork created by kids on the walls ▪ Curved patient floors divide nursing duties into six-room pods; equipment is centralized in inner nursing area of pod ▪ Outside patient room, each pod has table where staff and family can talk ▪ All patient rooms on the medical and surgical floors are single occupancy, allowing family privacy; each room includes a parent bed ▪ Natural light used extensively 	<ul style="list-style-type: none"> ▪ Preference towards single occupancy rooms to allow families privacy

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<p>Horsburgh, C. R. Jr. (1995, September 14)</p>	<ul style="list-style-type: none"> ▪ To describe current trends in hospital design that focus on the patients and their families 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Four qualities characterize good architecture: orientation, connection, scale, and symbolic meaning ▪ Orientation: use of signs, visual cues, and landmarks to help patients locate destinations and reducing their spatial confusion ▪ Connection: quality of interaction between people and their environment; use of open lobbies, alcoves in hallways for confidential discussions, windows with views of nature, and social spaces ▪ Scale: should provide variety, should accent changes in function & ambience, help define progression from private to public space ▪ Symbolic Meaning: atmosphere of security, cleanliness, and physical comfort should be conveyed 	<ul style="list-style-type: none"> ▪ Hospitals should be a combination of successful function and good architecture ▪ No mention made in regards to room occupancy

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<p>Hosking, S. & Haggard L. (1999)</p>	<ul style="list-style-type: none"> ▪ To describe the advantages and disadvantages of the Nightingale and Bay wards 	<ul style="list-style-type: none"> ▪ All Hospitals 	<ul style="list-style-type: none"> ▪ In the Nightingale ward, beds are arranged down each side of a long, narrow ward; nursing station is at one end and a convalescent bay is at the other end ▪ Nightingale wards became unpopular because they failed to meet the needs of privacy of patients ▪ Newer wards are designed in four-, six-, or eight-bed bays ▪ Bay designs offer more flexibility and greater privacy and intimacy; patients can be clustered according to illness or sex ▪ Disadvantages of the bay ward are the patient's view of nurses is diminished, which can increase anxiety; patients feel confined to their bay and find it difficult to approach others; it is harder for staff to be vigilant over noise and new sources of noise are introduced 	<ul style="list-style-type: none"> ▪ Both the bay and nightingale wards have advantages and disadvantages ▪ Rooms on these wards are multiple occupancy

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Jones, W. J. (1992)	<ul style="list-style-type: none"> ▪ To discuss emerging trends in healthcare facilities 	<ul style="list-style-type: none"> ▪ All hospitals 	<ul style="list-style-type: none"> ▪ Old hospital forms offered shelter, food, and some cleanliness ▪ Florence Nightingale inspired wards which were long, and open corridors with windows on both sides; the central elevator determined the size of the nursing units ▪ Hospitals are now designed in the form of bed clusters to reduce patient travel as well as the number of people associated with patient care ▪ Flexibility and adaptability are key to design; larger patient rooms in separable suites will be used to provide patient care 	<ul style="list-style-type: none"> ▪ Larger patient rooms will be used in future-oriented hospital to provide patient-care
Kaldenberg, D. O. (1999, January/February)	<ul style="list-style-type: none"> ▪ To discuss the impact that having a roommate has on patient satisfaction 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Hospitals with more private rooms tend to have higher patient satisfaction ▪ Patients without roommates were more satisfied with their stay than those with roommates ▪ Female patients with roommates were less satisfied than males; females without roommates were more satisfied than males ▪ Patients with roommates were least satisfied with the noise, pleasantness, cleanliness, and temperature in the room 	<ul style="list-style-type: none"> ▪ Patients' satisfaction with their hospital stay is greater for those who do not have roommates
Kennedy, S. P. (1994, March 21)	<ul style="list-style-type: none"> ▪ To describe how design should change to meet changing needs in healthcare 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Shift to outpatient services left inpatient facilities struggling to survive ▪ Buildings should be designed for short-term, but design should accommodate changes in long term ▪ Facilities should be flexible to permit change with minimum inconvenience and cost 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy

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Larson, L. (2003, February)	<ul style="list-style-type: none"> ▪ To describe the design for a new hospital whose focus is patient safety 	<ul style="list-style-type: none"> ▪ St Joseph’s Community Hospital, West Bend, Wisconsin 	<ul style="list-style-type: none"> ▪ All rooms in this facility will be private ▪ Rooms will be wired to use cameras with the patient’s permission to monitor the patient without disrupting them ▪ Rooms will have cabinets containing medicine locked up in boxes for the patient and other supplies needed to care for the patient ▪ Bedside computers used to double-check treatments and allow patients to see their records ▪ Hallways are shorter to minimize employee fatigue ▪ A small alcove adjacent to the room will enable nurses to observe patients through a window without disturbing them 	<ul style="list-style-type: none"> ▪ Rooms in this hospital are private, though no specific reason is given as to why this is the case
Leccese, M. (1992)	<ul style="list-style-type: none"> ▪ To describe the features, and in particular, the landscape of St. Michael’s Hospital 	<ul style="list-style-type: none"> ▪ St. Michael’s Hospital, Texas 	<ul style="list-style-type: none"> ▪ Patients have views of nature through floor-to-ceiling windows in rooms ▪ Landscape includes jogging paths, fountains, lake, and trees ▪ Large courtyards include seasonal plants 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy

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Leibrock, C. A. (2000)	<ul style="list-style-type: none"> ▪ To describe the design of hospitals 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Hospitals are moving away from general hospital delivery to ambulatory care ▪ In tertiary care hospitals, patients and family members are expected to take an active role in treatment ▪ Planetree model empowers patients with research; patient rooms are private and the patient's care partner stays with the patient in the room; the nursing station is decentralized into a series of pods that serves three to four patients ▪ A well-maintained garden provides sensory stimulation ▪ Art can stimulate the consciousness of the viewer ▪ ADA requirements must be met in facilities ▪ Stress can be reduced with wayfinding and nature scenes; sound can be a positive distraction ▪ Patients should have a sense of control over their personal space 	<ul style="list-style-type: none"> ▪ Patient-centered care gives the patients a sense of control as they are active participants in their care ▪ Room occupancy is mentioned for the Planetree facilities; rooms are private and are large enough to accommodate the patient and the caregiver
Lippman, H. (1991, July)	<ul style="list-style-type: none"> ▪ To describe the design at Irvine Medical Center 	<ul style="list-style-type: none"> ▪ Irvine Medical Center, California 	<ul style="list-style-type: none"> ▪ Philosophy is patient-centered with business orientation ▪ Rooms are all private and are divided into pods containing four rooms ▪ One nursing alcove exists for two pods; alcoves serve as mini-nursing stations where staff can discuss patients, print records, replenish supplies, and reach patients quickly 	<ul style="list-style-type: none"> ▪ Rooms in this facility are private, though reasons for this choice are not stated

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Lowers, J. (1999)	<ul style="list-style-type: none"> ▪ To describe how hospital design can incorporate the needs of patients 	<ul style="list-style-type: none"> ▪ Patient-centered hospitals in the U.S. 	<ul style="list-style-type: none"> ▪ Patients want safety, confidentiality, and sense of control ▪ Environment should provide connection to staff, be conducive to sense of well-being, be accessible, have private rooms to increase privacy and confidentiality, provide space for families, be safe and secure, and should provide connection to outside world ▪ Indirect lighting diffuses light and creates more natural effect ▪ Carpeted hallways keep noise to a minimum ▪ Temperature controls in rooms allow patients to adjust the temperature as needed ▪ Senses should be engaged through use of gardens, artwork, furniture, and lobbies ▪ Nursing stations should be accessible to patients; mini-nursing stations can eliminate central gathering point; staff need lounges to rest 	<ul style="list-style-type: none"> ▪ Private patient rooms are preferred to increase privacy and confidentiality as well as to enable family members to spend the night

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Lumsdon, K. (1996, November 5)	<ul style="list-style-type: none"> ▪ To discuss changes made to West Allis Memorial Hospital based on patient satisfaction surveys 	<ul style="list-style-type: none"> ▪ West Allis Memorial Hospital, Wisconsin 	<ul style="list-style-type: none"> ▪ Patient surveys suggested that patients did not want to share a semiprivate room with a stranger; not enough space in rooms for family member to spend the night; remedy is to incorporate private rooms ▪ Centralized nursing station removed and smaller satellite pods created to serve seven to nine patients ▪ Patient care associates, a new staff category, handle support tasks formerly done by nurses 	<ul style="list-style-type: none"> ▪ Private rooms will be created to improve patient care
Lumsdon, K. (1993, February 5)	<ul style="list-style-type: none"> ▪ To describe the design of patient-centered Mercy Hospital and Medical Center 	<ul style="list-style-type: none"> ▪ Mercy Hospital and Medical Center, San Diego 	<ul style="list-style-type: none"> ▪ Inpatient rooms transformed to lower patient stress levels and give them more control over surroundings ▪ Rooms larger to accommodate family and friends ▪ Artwork, paint, and wall coverings chosen are sensitive to patients' conditions ▪ Patient server, a cabinet of drawers and shelves, located in patient rooms ▪ Nursing areas decentralized and located at smaller pods throughout patient unit ▪ Addition of activity rooms, dining areas, and reference libraries 	<ul style="list-style-type: none"> ▪ Rooms in this facility are large and accommodate family members, though it is not specified if the rooms are private

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McMorrow, E (2001, March)	<ul style="list-style-type: none"> ▪ To describe The Center for Health Design Pebble Project 	<ul style="list-style-type: none"> ▪ San Diego Children’s Hospital and Health Center 	<ul style="list-style-type: none"> ▪ The Center for Health Design focuses on 5 core areas: Environmental standards, education/information, technical assistance, research, and partnerships with selected healthcare organizations ▪ 2 components to pebble project: emphasis on understanding how organizational behavior changes as a result of the planning and design process; development of a standardized evaluation methodology 	<ul style="list-style-type: none"> ▪ No mention of preference for single or multiple room occupancy
McTaggart, R. (1996, June)	<ul style="list-style-type: none"> ▪ To discuss the issues relevant to designing hospital ward with attention to staff bases 	<ul style="list-style-type: none"> ▪ Private rooms in a U. K. facility 	<ul style="list-style-type: none"> ▪ Staff base central to ward management ▪ Increased unit size for cost-reduction ▪ Less dependence on multi-bed rooms ▪ Core ward support services closer to all beds ▪ Improved visibility of entrance points and beds from staff bases ▪ Design includes 34 bed wards; patients in groups of 12; mainly single and 4 bed rooms; nursing teams are local to the group and have own staff base 	<ul style="list-style-type: none"> ▪ Ward designs should include 30-50% of patients in single rooms

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McTaggart, R. (1996, May)	<ul style="list-style-type: none"> ▪ To assess British ward design 	<ul style="list-style-type: none"> ▪ Hospitals in England 	<ul style="list-style-type: none"> ▪ Ward design should incorporate patient-focused care; use of Planetree model ▪ Non-clinical spaces should be included such as quiet lounges and rooms for counseling ▪ Patients should be given option to move from unwelcome neighbors, their own personal space, and room to escape ▪ Increases provisions for single rooms ▪ 2-bed room design with “L” - shape enables patients to have a sense of their own space; rooms should have en suite bathrooms ▪ Bed space should be adequate for bedside procedures ▪ Sexes should have own wards 	<ul style="list-style-type: none"> ▪ 2-bed “L”-shaped rooms can be economical and give patients a sense of their own space ▪ Increased provision for single rooms exists as marketing asset and for infection control

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Mader, B. (2002)	<ul style="list-style-type: none"> ▪ To discuss why private rooms are becoming the norm in Milwaukee hospitals 	<ul style="list-style-type: none"> ▪ Hospitals in Milwaukee 	<ul style="list-style-type: none"> ▪ Healthcare consumers expect and demand private rooms when they have a hospital stay; costs are increasing because of individual expectations <p>Advantages of private room:</p> <ul style="list-style-type: none"> ▪ Patients sicker now than in past; require more intensive care and privacy ▪ Helps with infection control ▪ More efficient layout ▪ For same number of beds, hospitals can achieve 15% improvement in room usage ▪ Ultimate cost savings from improved efficiencies <p>Advantages of semi-private room</p> <ul style="list-style-type: none"> ▪ Hard to justify private room creation in existing facility if volume high ▪ Entail less square footage per patient than private room <p>Disadvantages of semi-private room</p> <ul style="list-style-type: none"> ▪ Flexibility not as great as in private room ▪ Limitations to roommate pairing due to gender and infectious disease issues 	<ul style="list-style-type: none"> ▪ Patients prefer private rooms ▪ HMO's believe private rooms too costly ▪ Hospital administrators see private rooms as being cost-effective and prefer private rooms to semi-private rooms

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Martin, C. (2000)	<ul style="list-style-type: none"> ▪ To evaluate the 2nd International Conference on Health & Design in Stockholm, Sweden 	<ul style="list-style-type: none"> ▪ Hospitals in general 	<ul style="list-style-type: none"> ▪ Stress is scientific starting point for understanding how design affects medical outcome ▪ Design of healthcare facilities should be human centered, functionally efficient, and should benefit patients, families, and staff 	<ul style="list-style-type: none"> ▪ No mention of preference for single or multiple room occupancy
Miller, R. L. & Swensson, E. S. (1995)	<ul style="list-style-type: none"> ▪ To describe trends in the design of hospitals 	<ul style="list-style-type: none"> ▪ U.S. Hospitals 	<ul style="list-style-type: none"> ▪ Patient-focused room design given momentum by Planetree design ▪ Open ward made obsolete by the team approach to care and technological developments ▪ Patient-focused facilities will feature larger, single-occupancy rooms ▪ Flexibility of larger room reduced need of transporting patients ▪ Larger rooms are economically feasible in long-run as their flexibility allows them to be adapted for other uses such as rehabilitation and elderly housing ▪ Flexibility is also enhanced through uses of disabled-accessible bathrooms; all patients can use the room at all times; bathrooms should be located on outside wall ▪ Cluster of beds supervised by a nursing team recommended; easily managed to accommodate fluctuating patient census ▪ Bedside computers allow for more detailed and frequent updating of charts 	<ul style="list-style-type: none"> ▪ Patient-focused care incorporates single-occupancy rooms which provide for increased flexibility and adaptability

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Moore, J. P. (1974, February 1)	<ul style="list-style-type: none"> ▪ To discuss the renovations and expansions that occurred at Methodist Hospital 	<ul style="list-style-type: none"> ▪ Methodist Hospital, Lubbock, Texas 	<ul style="list-style-type: none"> ▪ Problems with old facility: majority of rooms were semiprivate or four-bed rooms ▪ New tower includes 5 floors of patient rooms; 190 new single-care rooms 	<ul style="list-style-type: none"> ▪ New facility includes large number of single occupancy rooms, though reasons are not given for preference of these rooms
Morrissey, J. (1998)	<ul style="list-style-type: none"> ▪ To discuss the acquisition of the Planetree organization by Griffin Health Services Corporation 	<ul style="list-style-type: none"> ▪ Planetree based hospitals in the U.S. 	<ul style="list-style-type: none"> ▪ Planetree has been acquired by Griffin Health Services Corp. ▪ Only 15 facilities have been converted since 1986 ▪ Trouble demonstrating ongoing benefit of paying \$15,000 licensing fee ▪ Planetree can't guarantee reduction in costs and greater operating efficiency 	<ul style="list-style-type: none"> ▪ No mention made of preference for single or multiple room occupancy

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Murphy, E. (2000, May)	<ul style="list-style-type: none"> ▪ To describe the patient rooms of the future which are designed to promote healing 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Light, color, nature, and ability to control one’s environment have healing effect ▪ Patient rooms will be larger to enhance comfort and include space for family members; comfortable seating, guest sleeping, and storage important ▪ Natural light should be used where possible; soothing and invigorating hues should be used 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy, though implication is that rooms are single occupancy as space is included for family members
Napthine, R. (1997/1998)	<ul style="list-style-type: none"> ▪ To describe the layout of a patient’s room 	<ul style="list-style-type: none"> ▪ All hospitals 	<ul style="list-style-type: none"> ▪ Nurses need adequate working space ▪ Space around patient’s bed inefficiently laid out ▪ Service outlets behind the patients’ bed-head often inaccessible; solution is to increase the number of wall-mounted services so they are readily accessible ▪ Towels behind bed-head or beside bedside lockers inefficient because nurses cannot reach these towels ▪ Other inefficiencies include shallow wardrobes, narrow shelves and doorways, and shallow hand basins ▪ Inefficiencies impact nurses; they may take longer to complete tasks or they may injure themselves in attempting to complete the task 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy

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Neumann, T. & Ruga, W. (1995, April)	<ul style="list-style-type: none"> ▪ To give suggestions, based on experience, on how to improve a nursing unit's environment 	<ul style="list-style-type: none"> ▪ St. Luke's Episcopal Hospital, Houston, Texas 	<ul style="list-style-type: none"> ▪ Viewing nature scenes can shift feelings to a more positive state, increase activity levels, decrease anxiety, reduce blood pressure and muscle tension, and minimize length of stay ▪ Natural images that can be seen or chosen by the patient are best ▪ Plants are useful ▪ Aquariums shown to decrease anxiety and discomfort and increase patient compliance ▪ Unnecessary noise should be minimized ▪ Patients should be encouraged to listen to music ▪ Soft blankets can help provide a good night sleep ▪ Ambient temperature should be assessed ▪ Negative odors should be eliminated and clean, therapeutic aromas should be used ▪ Comfortable seating should be provided for visitors and family members 	<ul style="list-style-type: none"> ▪ No mention of preference for single or multiple room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Noakes, T. & Glynis, M. (1998, October)	<ul style="list-style-type: none"> ▪ To describe the proposed ward design for the Millennium Hospital in New South Wales 	<ul style="list-style-type: none"> ▪ Millennium Hospital, King's Cross, New South Wales 	<ul style="list-style-type: none"> ▪ Wards will contain continuous bands of at least 200 beds per floor ▪ Clusters of eight beds: one four-bed and four single rooms; each cluster has own associated nurse station ▪ Each patient room has own drug cupboard for prescriptions ▪ Beds should be widely spaced to accommodate bedside care ▪ Increase in single rooms to help control hospital-acquired infection 	<ul style="list-style-type: none"> ▪ Hospital ward design will include combination of single and multiple occupancy rooms; Larger number of single occupancy rooms needed to help reduce risk of acquiring infection
Orr, S., Farrell, J., & Portman, F. (2002, August)	<ul style="list-style-type: none"> ▪ To discuss the viability of private rooms based on the opinions of nurses 	<ul style="list-style-type: none"> ▪ Hospitals in England 	<ul style="list-style-type: none"> ▪ Orr: Not viable for all patients to have single room; acutely ill patients need constant monitoring and single room may be hazardous ▪ Farrell: Concern with safety and security of patients in single room since harder to monitor; single rooms will reduce overall bed capacity; single rooms impractical ▪ Portman: Cost of single rooms huge; patients can become invisible; patients said they would rather be on a ward where psycho-social needs are met through contact with other patients 	<ul style="list-style-type: none"> ▪ From the perspective of nurses, single rooms are not ideal since the safety of patients may be jeopardized

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Patterson, M. (1999, July)	<ul style="list-style-type: none"> ▪ To describe the features of the Cardiac comprehensive care unit at Methodist Hospital 	<ul style="list-style-type: none"> ▪ Cardiac Comprehensive Care Unit at Methodist Hospital, Indianapolis 	<ul style="list-style-type: none"> ▪ Computers outside patient rooms for nurses to input patient information; windows in patient rooms are angled so nurses have visual access of 3 rooms simultaneously ▪ Patients have shelves by their bedside to keep personal materials ▪ Families have their own space within the patient room to encourage their participation as well as a retreat area outside the patient rooms ▪ Patient rooms are private 	<ul style="list-style-type: none"> ▪ Private rooms are used in this design and these rooms are large enough to accommodate family members who participate in the care of the patient
Rainey, J. B. (1990, May 19)	<ul style="list-style-type: none"> ▪ To describe the effects of moving from an open ward to a bay ward 	<ul style="list-style-type: none"> ▪ Hospital in Scotland 	<ul style="list-style-type: none"> ▪ Move was made from open ward to six-bed bays and single rooms ▪ New ward difficult to adjust to as patients were moved around; large amounts of time spent tracking down patients ▪ Counseling patients in six-bedded bays impossible; privacy greater on open ward ▪ Patients in single rooms can feel lonely and isolated; open ward offered patient chance to interact with others 	<ul style="list-style-type: none"> ▪ Preference is for open ward as privacy is greater and patients are able to interact with one another

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Shumaker, S. A. & Pequegnat W. (1989)	<ul style="list-style-type: none"> ▪ To discuss elements of design that can influence patient stress 	<ul style="list-style-type: none"> ▪ All hospitals 	<ul style="list-style-type: none"> ▪ Poor design and organization can directly affect health by hampering effective and timely delivery and receipt of healthcare; health can be affected indirectly by creating a stressful environment ▪ Sources of stress are factors that contribute to perceptions of inadequate control, lack of sufficient privacy, multiple and competing stimuli, and competing role demands ▪ Ambient stressors include noise, inadequate privacy, uncomfortable temperatures, and crowding ▪ Changes in technology associated with diagnosis and treatment influence patient care and hospital design; equipment demands large spaces ▪ Trend toward use of light, materials, and color to liven up human qualities of the environment ▪ Pattern of design of nursing unit may influence nurses' satisfaction and their delivery of health care 	<ul style="list-style-type: none"> ▪ No mention was made in regards to room occupancy
Solovy, A. (2002, December)	<ul style="list-style-type: none"> ▪ To describe the change in room design in hospitals 	<ul style="list-style-type: none"> ▪ U.S. Hospitals 	<ul style="list-style-type: none"> ▪ Larger private rooms with more family space have been driven by consumerism and view of family's role in treatment ▪ Rooms include foldout beds, desks, internet access, and greater control of lighting ▪ Privacy is increased 	<ul style="list-style-type: none"> ▪ Trend towards large private rooms to accommodate family members and to increase privacy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Spear, M. (1997)	<ul style="list-style-type: none"> ▪ To describe how the universal patient care room should be designed 	<ul style="list-style-type: none"> ▪ Massachusetts General Hospital, Boston 	<ul style="list-style-type: none"> ▪ Problem: most patient rooms fail to acknowledge family participation and there are too many double rooms; these rooms don't comply with ADA standards and medical equipment does not fit ▪ Recommendations: a universal patient room that is single occupancy; the hospital should be able to put any patient in any room; family members and others are included in the patient's care; want to reduce the number and frequency of patient transfers ▪ 4 functional processes go into patient's room: activities of daily living; communication among staff, visitors, families, patients, and students; interactions with the environment; therapies and diagnostic services 	<ul style="list-style-type: none"> ▪ Patient room should be single occupancy to enable better care of the patient

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
<p>Stichler, J. F. (2001, November)</p>	<ul style="list-style-type: none"> ▪ To describe how the critical care unit can be designed to enhance the healing process of patients 	<ul style="list-style-type: none"> ▪ Critical Care Units in U.S. Hospitals 	<ul style="list-style-type: none"> ▪ Patients experience a positive outcome in environment that incorporates natural light, elements of nature, soothing colors and pleasant sounds ▪ Trend toward use of universal rooms; provide more space for patient care, equipment, and family members ▪ Placing bathroom in each patient room or between patient rooms increases flexibility and adaptability of unit ▪ Visibility into and out of the room is critical; patients should have access to outside window too ▪ Optimal design would include a mini-nursing station between every two patient rooms ▪ Nursing station should be located centrally to allow visibility to all patient rooms ▪ Family waiting area should be large enough to accommodate visitors and should be adjacent to the critical care unit ▪ Staff lounge should be comfortable and should be located in an area that enables staff to return quickly to the unit ▪ Optimal size of patient unit is multiples of four beds ▪ Circular design - adv: centralization of care and immediate access to patient; disadv: noisy, storage area is reduced, & patient privacy minimized ▪ Triangular design – adv: reduces travel distance to patient rooms, maximized number of rooms designed, and allows for multiple nursing stations; disadv: 	<ul style="list-style-type: none"> ▪ Trend towards universal rooms increases patients’ comfort ▪ Various ward designs have both advantages and disadvantages

			<p>minimizes visualization of patients in remote corners and design is difficult to expand</p> <ul style="list-style-type: none">▪ Clustered design – adv: allow more patient rooms to be located on periphery, facilitate nurses' visualization, allows for use of mini nursing stations; disadv: decentralized approach to care and social needs of nurses not always met▪ Rectilinear design: adv: cost, centralized location for supplies, and improved way-finding; disadv: distance traveled by nurses, visualization of patients decreased, and space required for patient rooms	
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Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Thompson, J. D. & Goldin, G. (1975)	<ul style="list-style-type: none"> ▪ To discuss ward design in British hospitals 	<ul style="list-style-type: none"> ▪ British hospitals 	<ul style="list-style-type: none"> ▪ Hospitals in Britain place an emphasis on supervision and economy rather than privacy of patients ▪ Important for nurses is the ability to see their patients, to respond quickly to an emergency, and to reach a patient in the shortest amount of time possible ▪ The Nightingale ward was designed as an open ward with beds in two rows; 2 toilets were available for every 25-30 beds ▪ Private rooms were available for those who were extremely ill or dying and for those who had an infectious disease ▪ Nuffield studies determined that nurses could handle 8 patients during peak periods and double that during non-peak periods; wards were designed in multiples of 8 beds with 32 beds being the average unit ▪ The use of artificial ventilation to reduce the risk of infection changed the design of wards 	<ul style="list-style-type: none"> ▪ Hospitals in Britain tend to favor the use of multiple-occupancy rooms to facilitate supervision of patients, though there are some proponents of single-occupancy rooms

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Thompson, J. D. & Goldin, G. (1975)	<ul style="list-style-type: none"> ▪ To discuss the issue of privacy in hospitals in relation to room occupancy 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Desire for privacy affected by social class; those of poorer classes generally resent being left alone in a hospital room ▪ Florence Nightingale was against private rooms and instead favored a ward design that facilitated the nurses' supervision of patients ▪ Private rooms were used for medical reasons and for social reasons, usually by those who could afford them ▪ A Bacon suggests that private rooms are more efficient; they allow for maximum ward capacity and patients do not need to be moved, reducing the risk of infections; better examinations can be made and room temperature can be adjusted to suit the needs of the patient ▪ After World War II, the benefit of private rooms was increased as it was noted that private bathrooms enabled patients to recover faster ▪ Economically, multi-bed rooms had an advantage as more patients could be placed along the same corridor; nurses also had to walk less to tend to patients 	<ul style="list-style-type: none"> ▪ Private rooms are favored among patients of the upper social classes, while patients in lower social classes prefer shared rooms

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<p>Tidwell C., & Sowman, J. (2002)</p>	<ul style="list-style-type: none"> ▪ To demonstrate how effective healing environments have proven to produce quantifiable effects on patient experience 	<ul style="list-style-type: none"> ▪ Florida Hospital Heartland Medical Center (wellness & medical center) ▪ Woman's Health Center in Bellmore, New York 	<ul style="list-style-type: none"> ▪ 3-story facility ▪ Reception area offers info center and gift shop; clear orientation ▪ 2nd & 3rd floors include inpatient rooms and services; nurses' station dispersed-1 nurse can view 4 patients simultaneously ▪ Private patient rooms; use of neutral colors, natural light, & comforting artificial lighting ▪ Restrooms on exterior wall of inpatient rooms ▪ Courtyard ▪ Integrates ideas and images related to garden, greenhouse, and lantern ▪ Enhances quality of light by using skylights ▪ Use of soothing colors, warm textures, and natural materials 	<ul style="list-style-type: none"> ▪ Private rooms preferred ▪ Welcoming design communicate wellness, good health, and reach out to the community; Care delivered with greater efficiency ▪ No mention of preference for single or multiple room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Tradewell, G. B. (1993)	<ul style="list-style-type: none"> ▪ To describe the design of patient care units 	<ul style="list-style-type: none"> ▪ All hospitals 	<ul style="list-style-type: none"> ▪ Nightingale ward: open ward design with a nurse located among patients; support spaces are located outside the ward; visibility of patients the goal; ward houses 30-32 beds ▪ Continental design: patient rooms located on one or both sides of a corridor; use of rooms with 4-6 beds; central nursing unit; support space on unit ▪ Racetrack design: patient rooms are farther apart and support spaces located between two corridors; design not favored because of long travel distances, only one nursing station for a large number of beds, visualization is poor, and only contains one clean and one soiled utility room ▪ Cluster design: patient rooms organized around nursing substations; one of the stations is dedicated as central nursing station ▪ Triangles: reduces travel times and distances by nurses ▪ Criteria for designs are: patient rooms, observation, nursing stations, distribution of support space, flexibility, and travel distance 	<ul style="list-style-type: none"> ▪ Ward design must take into account factors such as the patient room, the nursing station, as well as observation of patients and travel distance ▪ Room occupancy varies among the ward designs and was not emphasized in the article

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Ulrich, R.S. (1997)	<ul style="list-style-type: none"> ▪ To describe factors of hospital design that contribute to positive outcomes for patients 	<ul style="list-style-type: none"> ▪ U.S. Hospitals 	<ul style="list-style-type: none"> ▪ Design takes into account strategies and environmental qualities that may positively affect patient outcomes ▪ Design that fails to support patients and their attempts to cope with stress can have negative effects on health outcomes ▪ Design should incorporate a sense of control with respect to physical surroundings, access to social support, and access to positive distractions ▪ Supportive design can reduce patient stress and anxiety, reduce pain, improve satisfaction, and lower costs 	<ul style="list-style-type: none"> ▪ Through supportive designs, patients can experience positive outcomes ▪ No mention made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Verderber, S. & Fine, D. J. (2000)	<ul style="list-style-type: none"> ▪ To describe the design of patient care units 	<ul style="list-style-type: none"> ▪ Hospitals in the U.S. and Europe 	<ul style="list-style-type: none"> ▪ Cluster unit design minimized distances traveled by nurses and delivered a higher level of care than traditional linear units ▪ Planetree movement suggested that hospital care should maximize the involvement of patients and family members; emphasis on improved education, personalization, and demystification of illness; determined that patients were denied supportive human relationships, physical comfort, and independence ▪ Transformational rooms can be converted and reverted to their initial stage; functions of these rooms alterable ▪ Bedside computers enable nurses to input patient data quickly and data is made available to the patients ▪ Private patient rooms are larger in size to accommodate equipment as well as family members 	<ul style="list-style-type: none"> ▪ Patient rooms have evolved from open wards to private rooms that are large enough to accommodate equipment and family members

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Voelker, R. (1994, December 28)	<ul style="list-style-type: none"> ▪ To describe the use of the Planetree philosophy in hospitals 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Planetree combines soothing, efficient surroundings and emotional support with medical care ▪ Included in the design is soft lighting, carpets to absorb noise, and soothing artwork and colors ▪ Patient should have control of their surroundings such as lights, temperature, and television ▪ Patients should be able to bring their favorite possessions ▪ Indoor air quality should be good ▪ Nursing stations should welcome communication ▪ Windows help maintain connection with nature 	<ul style="list-style-type: none"> ▪ Patient-centered environments provide a soothing atmosphere for healing ▪ No mention was made in regards to room occupancy though the design appears to favor private rooms
Watkins-Miller, E. (1998, February)	<ul style="list-style-type: none"> ▪ To describe the features of the Marburg Pavilion at John Hopkins Hospital 	<ul style="list-style-type: none"> ▪ Marburg Pavilion at John Hopkins Hospital, Baltimore 	<ul style="list-style-type: none"> ▪ Cost is \$800 a day for a private room with elegant furnishings and hotel-like amenities such as hardwood floors, wooden cabinets, television, and fax machine ▪ Warm hues are used to make setting comfortable ▪ Lighting is warm and appropriate for each setting- brighter in some areas, and lower in other areas ▪ Artwork and patterns are used as wayfinding devices 	<ul style="list-style-type: none"> ▪ Private rooms with elegant features are used to make the stay more pleasant for the patient

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Weber, D.O. (1995, March-April)	<ul style="list-style-type: none"> ▪ To describe features that promote a therapeutic environment in hospitals 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Healthcare architects should design for the spiritual, mental, and emotional dimensions of patients ▪ Planetree incorporates patient-centered values: access to information, participation, autonomous decision-making, involvement of family and friends, choice, respect for the individual, & provision of supportive human and physical environments ▪ Air should be properly filtered and ventilated ▪ Natural fragrances have been used to improve air quality and promote healing ▪ Excess noise can be reduced through source attenuation and source elimination ▪ Use of music and natural sounds can contribute to wellness ▪ Effective lighting and daylight should be incorporated into the design 	<ul style="list-style-type: none"> ▪ Design should include features that promote healing ▪ No mention made in regards to room occupancy
Weisman, E. (1994, November)	<ul style="list-style-type: none"> ▪ To describe the design of Griffin Hospital 	<ul style="list-style-type: none"> ▪ Griffin Hospital, Derby, Connecticut 	<ul style="list-style-type: none"> ▪ Design based on Planetree philosophy ▪ Rooms are semi-private; L-shape design used; offers patients sense of own space ▪ Three 23-bed units created with two swing beds that can be used by family members ▪ Satellite nursing stations used; branch off main corridor and are surrounded by cluster of 3 or 4 rooms 	<ul style="list-style-type: none"> ▪ Semi-private rooms in an L-shaped design are used; offers patients sense of own space

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
<p>Withecumbe, P. (1997)</p>	<ul style="list-style-type: none"> ▪ To describe how the ‘Echelon’ and ‘Focus’ methods of ward planning are efficient and aid in patient comfort 	<ul style="list-style-type: none"> ▪ ‘Echelon’ ward design: Mold Community Hospital, Wales ▪ ‘Focus’ ward design: Princess of Wales DGH Bridgend 	<p>Echelon Design:</p> <ul style="list-style-type: none"> ▪ 20 bed ward; nurses’ base located centrally with direct view into each 8 bed bay ▪ L shape makes length of corridor appear shorter ▪ Staggered bed head wall arrangement; each bed in a corner area within the bay and is visible from the nurses’ base ▪ Each patient’s bed area has its own ambience <p>Focus Design:</p> <ul style="list-style-type: none"> ▪ 2 X 23 bed acute ward template ▪ Incorporates Echelon bays clustered around a central nurse base ▪ Short travel distance to utility rooms 	<ul style="list-style-type: none"> ▪ Echelon Design: Enhanced amenity and privacy for the patient; Ease of observation for the nursing staff; cost-efficient; Rooms with multiple beds are desired ▪ Focus Design: Cost-effective; ward accommodation approximately 40% of total footprint area of acute hospital

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Williams, M. (2001, November)	<ul style="list-style-type: none"> ▪ To describe the design of a critical care unit based on the premise of offering more efficient care as well as a comfortable environment for patients 	<ul style="list-style-type: none"> ▪ Critical Care Units in U.S. hospitals 	<ul style="list-style-type: none"> ▪ Layout of central nursing station should allow for direct and indirect visualization of each patient ▪ Separate entrances should exist for visitors and healthcare providers as well as for patient transfer and transport ▪ Patient rooms need an outside window as well as direct visualization from the central nursing station ▪ Patient room divided into patient area, family area, and caregiver area ▪ Temperature should be adjusted for each individual room ▪ Board that displays personal belongings can help room feel less technical ▪ Artwork featuring nature scenes can be comforting ▪ Family waiting area should be large enough to accommodate visitors 	<ul style="list-style-type: none"> ▪ The rooms in the critical care units should be visible from the nurses' stations and should be large enough to accommodate patients and their family members ▪ Room occupancy was not specified, though the description implied a private room design
Williams, M. A. (1988)	<ul style="list-style-type: none"> ▪ To review literature linking physical environment factors to patient care 	<ul style="list-style-type: none"> ▪ Hospitals in the U.S. and the U.K. 	<ul style="list-style-type: none"> ▪ Design: 2 main aspects related to effective and efficient nursing care: short travel distances and features that maximize contact between nurses and patients ▪ Spatial Environment: Relationship between space use and staff role defined by social organization ▪ Sound: Infants particularly vulnerable to adverse effects of continual loud sound ▪ Physical environment serves symbolic role and role in facilitating therapeutic processes 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy

Empirical Articles Disease Control and Falls Prevention

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Anderson, J. D., Bonner, M., Scheifele, D. W., & Schneider, B. C. (1985)	<ul style="list-style-type: none"> ▪ To compare hospital rooms that are equipped with negative pressure ventilation to hospital rooms without this ventilation system in terms of prevention of nosocomial infections 	<ul style="list-style-type: none"> ▪ Patients with varicella zoster were transferred to the Isolation Unit ▪ They were in single occupancy rooms and were nursed using strict isolation techniques ▪ Susceptible patients were defined as being on the ward at the same time as the infected patient and having no previous history or exposure to chicken pox 	<ul style="list-style-type: none"> ▪ Site: Isolation Unit at British Columbia's Children's Hospital ▪ Sample: 125 susceptible patients and 5 index cases admitted to the Isolation Unit 	<ul style="list-style-type: none"> ▪ Seven out of 41 susceptible patients acquired chicken pox from 2 index cases in the old Isolation Unit in 1979 ▪ On the new unit, of the 100 susceptible patients, none had been infected 	<ul style="list-style-type: none"> ▪ Negative pressure ventilation appears to be beneficial in preventing the spread of chicken pox on an isolation unit ▪ Rooms in this study were private as it was an Isolation Unit
Groves, J. E., Lavori, P. W., Rosenbaum, J. F. (1993)	<ul style="list-style-type: none"> ▪ To study the frequency and types of incident reports filed for patients by nursing staff 	<ul style="list-style-type: none"> ▪ Incident reports were retrieved from the files of the legal department of the hospital ▪ The Report of Incident or Unusual Occurrence form was used to record incidents; it includes details such as the patients' names, unit number, attending physician, incident location and time, and nature of injury 	<ul style="list-style-type: none"> ▪ Site: A 1,082-bed tertiary-care hospital ▪ Sample: 806 medical and surgical patients 	<ul style="list-style-type: none"> ▪ Of the subjects included, 107 patients experienced 161 incidents ▪ 93 incidents were "hazardous" (nonmedication), and of these, 18 were minor injuries ▪ Hazardous incidents were more common among males 20 to 40 years old and medically ill females over the age of 60 	<ul style="list-style-type: none"> ▪ No mention was made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Hendrich, A., Nyhuis, A., Kippenbrock, T., & Soja, M. E. (1995, August)</p>	<ul style="list-style-type: none"> ▪ To develop a risk model that could be used to assess and identify levels of risk of falls in acute care populations ▪ To identify key areas for nursing interventions and fall-prevention programs 	<ul style="list-style-type: none"> ▪ Retrospective chart review done using epidemiological approach; ▪ Incident reports were used to assess falls ▪ Risk factors were measured using information found in the patient record, especially nursing assessments 	<ul style="list-style-type: none"> ▪ Site: 1,120-bed Midwest teaching institution ▪ Sample: 102 fall charts and 236 non-fall charts 	<ul style="list-style-type: none"> ▪ Most falls occurred in the patients' bedrooms when alone and unassisted while trying to get to the bathroom ▪ No significant differences found between nursing shifts ▪ Intervention programs suggested are based on increased patient observation, the environment, bladder training, assistance with and promotion of mobility, and patient deterioration 	<ul style="list-style-type: none"> ▪ Programs should be developed that take into consideration risk factors of patients in regards to their falls ▪ No mention was made in terms of room occupancy, though the majority of falls occurred while the patient was alone in his or her room

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Jones, W. & Simpson, J. A. (1991, Summer)</p>	<ul style="list-style-type: none"> ▪ To examine the role of patient age and diagnostic status in predicting patient falls 	<ul style="list-style-type: none"> ▪ Incident reports were collected from the facilities ▪ Control groups of non-incident patients were set up at both facilities ▪ Data was collected on patient age and diagnostic status 	<ul style="list-style-type: none"> ▪ Site: Large urban medical center and small psychiatric facility in Memphis, Tennessee ▪ Sample: 234 fall patients and 185 control patients at the medical center; 96 fall patients and 100 control patients from the psychiatric facility 	<ul style="list-style-type: none"> ▪ A sharp rise occurs in falls of patients over the age of 60 at the medical center ▪ At the psychiatric facility, 36% of falls occurred to patients 19 years of age and under; 30% of falls occurred in patients over 60 years of age ▪ At the medical center, the most likely patients to fall were those suffering from circulatory disorders ▪ At the psychiatric facility, patients suffering from affective disorders were most likely to fall; those with substance-dependence problems also had a greater likelihood of falling 	<ul style="list-style-type: none"> ▪ Patient age and diagnostic status were significant predictors of incident status ▪ No mention was made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Langner, D. (1996, September)	<ul style="list-style-type: none"> ▪ To analyze factors that are associated with falls on a busy surgical and urological unit 	<ul style="list-style-type: none"> ▪ A form was used which included data on cot-sides in situ/refusal, bell at hand, occupancy status, and the number of staff on duty ▪ Criteria for falls used in the analysis included time of day, age group, location of accident, cot-side influence, patient activity, and type of injury 	<ul style="list-style-type: none"> ▪ Site: The surgical and urological unit in a private hospital in Durban; the unit consists of 4 general wards, 5 semi-private wards and 5 private wards ▪ Sample: 22 patients that suffered falls during the time frame of the study 	<ul style="list-style-type: none"> ▪ The majority of accidents occurred between 8 and 10 am ▪ Highest accident rate occurred when patients were on their way to the bathroom ▪ At night, most accidents occurred between midnight and 4 am ▪ Accidents were most frequent among patients between 70 and 80 years of age ▪ Type of ward had little influence on the occurrence of an accident ▪ Of the patients who fell, 45% suffered an injury 	<ul style="list-style-type: none"> ▪ Accidents were most likely to occur among the elderly, and those on their way to the bathroom ▪ Ward design did not impact the incidence of falls

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Levene, S. & Bonfield, G. (1991)	<ul style="list-style-type: none"> ▪ To investigate accidents occurring to children on pediatric units in terms of factors associated with accidents ▪ To propose measures that may reduce the frequency and severity of accidents 	<ul style="list-style-type: none"> ▪ Questionnaires were distributed over a one year period ▪ Information collected included details regarding the accident; this consisted of the injured person and the injury sustained and the supervision of the child 	<ul style="list-style-type: none"> ▪ Site: Eight hospitals with pediatric wards ▪ Sample: Inpatients outpatients or visitors age 16 or under; 781 questionnaires were collected 	<ul style="list-style-type: none"> ▪ Accidents were more frequent amongst boys of all ages and children under the age of 5 ▪ Most common accident was a fall from a height followed by being struck by or coming into contact with equipment ▪ Most common result of an accident was no injury ▪ Most common injuries included bruises and lacerations; most common injured site was the head 	<ul style="list-style-type: none"> ▪ Although most accidents did not result in injuries, most accidents could have been prevented ▪ No mention made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Mulin, B., Rouget, C., Clement, C., Baily, P., Julliot, M., Viel, J. F., et al. (1997)	<ul style="list-style-type: none"> ▪ To assess the rate and routes of <i>Acinetobacter baumannii</i> colonization and pneumonia among patients who were mechanically ventilated in a surgical intensive-care unit 	<ul style="list-style-type: none"> ▪ Specimens were screened for the presence of <i>Acinetobacter baumannii</i> ▪ Patients were screened over a six month period before and after modifications took place to the unit ▪ The unit was modified from 7 isolation rooms and 2 open rooms with 4 beds each to a unit with 15 isolation rooms, each with a hand-washing sink 	<ul style="list-style-type: none"> ▪ Site: University Hospitals of Besancon, France ▪ Sample: 135 patients prior to the renovation; 179 patients after the renovations 	<ul style="list-style-type: none"> ▪ 29 of 135 patients before the renovations had infected bronchopulmonary tracts versus 2 of 179 patients admitted after the renovations ▪ Rate of colonization was 28.1% prior to the renovations and 5% after the renovations ▪ Colonization was associated with prolonged stay in hospital; acquisition of infection by cross-transmission was the major route for colonization 	<ul style="list-style-type: none"> ▪ Move from open to isolation rooms may help control the acquisition of <i>A. baumannii</i> in mechanically ventilated patients
Pullen, R., Heikaus, C., & Fusgen, I. (1999, December)	<ul style="list-style-type: none"> ▪ To identify risk factors that contribute to patient falls 	<ul style="list-style-type: none"> ▪ Falls were recorded prospectively during a one-year period ▪ A formal check list was used to document the circumstances of each fall by the nurse or therapist in charge of the patient's care 	<ul style="list-style-type: none"> ▪ Site & Sample: All falls that occurred at a geriatric hospital 	<ul style="list-style-type: none"> ▪ 536 falls occurred at the 5 hospital wards during the period studied ▪ Only 11 falls were observed by medical staff ▪ Most falls occurred when the patient was alone or together with other patients in their rooms; 444 falls were recorded in the rooms ▪ 74 falls occurred when the patients were alone in the bathroom 	<ul style="list-style-type: none"> ▪ Improved monitoring is needed to prevent patient falls ▪ Most falls occurred in the patient room; the majority of the rooms were multiple occupancy (two-, three-, or 4-bed); only 4 rooms were single occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Seltzer, E., Schulman, A., Brennan, P.J., & Lynn, L. A. (1993, December)</p>	<ul style="list-style-type: none"> ▪ To examine patient attitudes in regards to rooming with patients with HIV infection and other medical conditions 	<ul style="list-style-type: none"> ▪ Surveys were administered to patients to examine their preference for single or double occupancy rooms, to assess their knowledge of HIV, and to inquire about their attitudes regarding rooming with a patient who had HIV, cancer, pneumonia, dementia, or disfiguring skin lesions ▪ Surveys were structured and interviewer-administrated 	<ul style="list-style-type: none"> ▪ Site: A University hospital in an inner city ▪ Sample: 104 inpatients 	<ul style="list-style-type: none"> ▪ 55% of patients said they would object to rooming with a person with HIV; of these patients, 46% preferred a private room ▪ A significant number of objectors felt they had a right to know why their roommate was in the hospital and had poorer knowledge about the transmission of HIV ▪ Patients did not know the hospital policy on HIV transmission, nor did they ask 	<ul style="list-style-type: none"> ▪ Lack of knowledge regarding HIV infection may be an underlying cause to people's fear of rooming with HIV-positive patients ▪ The majority of patients preferred a private room instead of sharing a room with an HIV – positive patient

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Shirani, K. Z., McManus, A. T., Vaughan, G. M. et al. (1986)</p>	<ul style="list-style-type: none"> ▪ To investigate the effect of using isolation measures on the infection and mortality rates of burn victims 	<ul style="list-style-type: none"> ▪ The original ward was open and consisted of limited hand washing facilities; the renovated unit consisted mainly of private rooms, each with a sink ▪ Paints were assessed for infections through daily through physical examinations and laboratory tests ▪ Observed and predicted mortality were compared 	<ul style="list-style-type: none"> ▪ Site: An open intensive care ward and renovated intensive care ward ▪ Sample: 173 patients on an open intensive care ward and 213 patients on a renovated intensive care ward 	<ul style="list-style-type: none"> ▪ The observed mortality was significantly lower than the predicted mortality on the renovated ward for non-infected patients ▪ Infections that were reduced on the renovated ward were bactermia and urinary tract infection 	<ul style="list-style-type: none"> ▪ The incidences of nosocomial infections and mortality were decreased through changes in the patient environment ▪ Having an individual room with its own hand washing facility appears to decrease the risk of infection for burn patients

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Stelfox, H. T., Bates, D. W., & Redelmeier, D. A. (2003, October 8)</p>	<ul style="list-style-type: none"> ▪ To examine the quality of care received by patients who are in isolation due to infection control 	<ul style="list-style-type: none"> ▪ Consecutive adults admitted to both hospitals who were isolated for at least two days with MRSA were identified ▪ Patients were either in a general cohort, which included all diseases, or a disease-specific cohort, which included patients with congestive heart failure ▪ Two matched controls were identified for each isolated patient ▪ Patient charts were reviewed for demographic, hospital, and clinical data; process of care measures included documentation of patient vital signs and clinicians' narrative notes ▪ Adverse events were recorded and patient satisfaction was measured 	<ul style="list-style-type: none"> ▪ Site: Sunnybrook and Women's College Health Sciences Centre in Toronto, Ontario & Brigham and Women's Hospital in Boston, Massachusetts ▪ Sample: 78 isolated patients and 156 control patients in the general cohort & 72 isolated patients and 144 control patients in the congestive heart failure cohort 	<ul style="list-style-type: none"> ▪ Isolated patients were more likely to have their vital signs incompletely recorded and to have days where they were not recorded at all ▪ Isolated patients were twice as likely as control patients to experience adverse events ▪ Isolated patients were 8 times more likely to experience supportive care failures such as falls and pressure ulcers ▪ Isolated patients had longer hospitalizations and expressed greater dissatisfaction with their treatment 	<ul style="list-style-type: none"> ▪ Patients in isolation due to infection control are more likely to experience an adverse event than patients not in isolation

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Sutton, J. C. (1994, March/April)	<ul style="list-style-type: none"> ▪ To report data on three studies which assess accidents in hospitals 	<ul style="list-style-type: none"> ▪ Study 1: Data were collected over a 1-year period; data was collected from patient accident reports, patient interviews, nurses' questionnaires, and medical and nursing records ▪ Study 2: Comparative study of 50 reported accident and 50 non-accident patients; data was same as in 1st study ▪ Study 3: Inpatients in the first two studies were asked whether they sustained an accident while in hospital; records were checked to see if an accident report form was completed 	<ul style="list-style-type: none"> ▪ Site: 10 wards in a large acute care hospital ▪ Sample: 515 inpatients 	<ul style="list-style-type: none"> ▪ 382 patients had one accident and 133 had multiple accidents ▪ Most accidents occurred to patients over the age of 60 ▪ Accident rate was greater for males ▪ Patients who had accidents were most frequently diagnosed with a neurological disorder ▪ One-third of patients were injured as a result of their accidents ▪ Majority of reported accidents were falls ▪ 83% of the patient accidents were as caused by the patients' condition by staff ▪ Nurses estimated the visual and hearing acuity of patients as being better than what the patients judged themselves 	<ul style="list-style-type: none"> ▪ Falls were the most common type of accidents, and the elderly are most prone to experience an accident ▪ No mention was made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Tutuarima, J. A, van der Meulen, J. H. P., de Haan, R. J., van Straten, A., & Limburg, M. (1997)</p>	<ul style="list-style-type: none"> ▪ To assess the incidence of falls as well as identify risk factors for patients hospitalized as a result of a stroke 	<ul style="list-style-type: none"> ▪ Trained nonmedical research assistants collected data from medical and nursing records ▪ Information included type of stroke, stroke severity, medical history, comorbidity, neurological deficits, complications, use of medications, and intensity of nursing care ▪ Information was collected regarding the circumstances of a patient's fall, if one occurred 	<ul style="list-style-type: none"> ▪ Site: 23 hospitals in the Netherlands ▪ Sample: 720 acute stroke patients 	<ul style="list-style-type: none"> ▪ 104 of the 720 stroke patients fell at least once; a total of 173 falls occurred ▪ Risk factors increasing the likelihood of a fall were heart disease, mental decline, confusional state, and urinary incontinence ▪ Risk of falling a second time increased for patients who had fallen once before ▪ Most falls occurred in the day, in the patients' room, and during visits to the bathroom ▪ Approximately 25% of the falls resulted in injuries 	<ul style="list-style-type: none"> ▪ Patients who suffered from a stroke had a relatively high risk for falling ▪ Although a large number of falls occurred in the patients' rooms, room occupancy was not mentioned

Non Empirical Studies First and Operating Costs of Hospitals

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Eickhoff (2003, August)	<ul style="list-style-type: none"> ▪ To discuss recommendations made in the SHEA Guideline for preventing nosocomial transmission of VRE 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ VRE recommendations suggest establishing an institutional program for active surveillance ▪ Problem with active surveillance is insensitivity of the surveillance instrument ▪ 60-70% of hospitals do not carry out active surveillance ▪ Errors could become locked in policy and damage could be done to the academic respectability of hospital epidemiology ▪ Careful resource management may make it difficult to establish active surveillance for VRE 	<ul style="list-style-type: none"> ▪ No mention was made in regards to room occupancy
Kappstein, I. & Daschner, F.D. (1991)	<ul style="list-style-type: none"> ▪ To summarize effective procedures for preventing hospital-acquired staphylococcal infections 	<ul style="list-style-type: none"> ▪ Hospitals in general 	<ul style="list-style-type: none"> ▪ Frequent hand-washing key to control hospital-acquired infections ▪ Private rooms only necessary for patients with staphylococcal pneumonia or skin lesions that cannot be covered by a dressing ▪ Architectural design is one of most costly and least effective measures in preventing staphylococcal infections ▪ Isolation of patient with MRSA is reasonable since it may become endemic 	<ul style="list-style-type: none"> ▪ Most effective measure for preventing staphylococcal infections ▪ Isolation is necessary in the case of patients with MRSA

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
<p>Muto, C. A., Jernigan, J. A., Ostrowsky, B. E., Richet, H. M., Jarvis, W. R., Boyce, J. M., & Farr, B. M. (2003, May)</p>	<ul style="list-style-type: none"> ▪ To present an evidence-based guideline on preventing the transmission of nosocomial infections 	<ul style="list-style-type: none"> ▪ Hospitals in general 	<ul style="list-style-type: none"> ▪ Observation of MRSA has been controlled with rigorous infection control practices designed to prevent transmission; use of stringent barrier precautions, cohort nursing, and isolation of patients until determined to be free of MRSA ▪ Infection control practices, including isolation, influence VRE transmission rates ▪ Transmission of VRE can occur via contaminated hands of healthcare workers or via having the same healthcare worker as an infected patient; proximity to an unisolated patient is a major risk factor as well ▪ Cleaning and disinfecting policies should be developed to control environmental contamination ▪ Patient outcomes are improved and health care costs are reduced through an infection control program that emphasizes early identification of infected patients 	<ul style="list-style-type: none"> ▪ Infection control programs help to control the transmission of infection in hospitals ▪ Isolation of the infected patient aids in reducing the transmission of infections

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
O'Connell, N. H. & Humphreys, H. (2000)	<ul style="list-style-type: none"> ▪ To describe the design of the intensive care unit to help prevent the spread of hospital-acquired infections 	<ul style="list-style-type: none"> ▪ Hospitals in general 	<ul style="list-style-type: none"> ▪ Design should minimize entry and persistence of micro-organisms; thorough cleaning of surfaces should be facilitated ▪ Transmission of resistant strains is promoted through poor compliance with hand-washing protocols, shortages of nursing staff, and high density of crowding of patients ▪ Patients requiring isolation should be placed in single rooms ▪ Ratio of one cubicle to six bed spaces is recommended, though it may be lower in some cases ▪ Enough space should be provided around the bed to separate patients ▪ Hand basins should be provided for every other bed; they should be equipped with elbow or foot operated faucets ▪ Air pressure differential should exist between the patient's room relative to the unit 	<ul style="list-style-type: none"> ▪ Hand-washing is the most important infection control measure ▪ Private rooms are needed for patients requiring isolation

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Ognibene, F. P. (2000)	<ul style="list-style-type: none"> ▪ To discuss the requirements that are needed to deal with the risk of an infection in an Intensive Care Unit. 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ In intensive-care units, immuno-compromised hosts are more common & resistant organisms can be dispersed throughout the unit; patients can then become infected by the resistant organism ▪ Standard source isolation measures include a single-occupancy room, aprons or gowns, gloves, and handwashing ▪ Airborne infected patients should be in tightly sealed isolation rooms with separate areas for handwashing, gowning, and storage ▪ Protective environment rooms have positive air pressure relative to the adjoining space; purpose is to limit anything from the outside from entering and contaminating high-risk patients; rooms could be risky if a respiratory pathogen is involved ▪ MRSA can occur in patients with previous hospitalizations, intravascular lines, ICU admission, and recent antibiotics ▪ VRE can be transmitted from colonized patients or from inadequate compliance with handwashing precautions 	<ul style="list-style-type: none"> ▪ Larger-sized single rooms are recommended to accommodate equipment, sinks in every room, and the ability to store contaminated products ▪ Large, multi-patient rooms can increase the spread of infection if patients become infected

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
<p>Sehulster, L., & Chinn, R. Y. W. (2003, June 6)</p>	<ul style="list-style-type: none"> ▪ To review previous guidelines and make recommendations for preventing environment-associated infections in healthcare facilities 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Severely immunocompromised patients should have minimal exposure to activities that may cause aerosolization of fungal spores; time outside of their rooms should also be minimal ▪ Ventilation specifications and dust-controlling processes should be incorporated in the planning and construction of protective environments ▪ Rooms of immunocompromised patients should maintain positive pressure ▪ Patients diagnosed with or suspected of having an airborne infectious disease should be placed in an isolation room ▪ Standard cleaning and disinfecting protocols should be used to control environmental contamination 	<ul style="list-style-type: none"> ▪ Patients with airborne infectious diseases should be placed in isolation

Empirical Studies
Therapeutic Impacts: Relationship between healing and environment

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Baker, C. F., Garvin, B. J., Kennedy, C. W., & Polivka, B. J. (1993)</p>	<ul style="list-style-type: none"> ▪ To examine the effects of environmental sounds and communication on the cardiovascular responses of coronary care patients 	<ul style="list-style-type: none"> ▪ High ambient stressors were classified as sounds inside and outside the room ▪ Social stressors included room conversation and hall conversation ▪ Low ambient sounds were continuous sounds in the room from lighting, heating, and ventilation ▪ Cardiac monitors were used to obtain an electrocardiogram ▪ Blood pressure was measured every 3 minutes ▪ Trait anxiety was measured at the conclusion of data collection ▪ Data were collected continuously for five 45-min periods in the morning, midday, and in the early evening of day one and in the morning and midday on day two 	<ul style="list-style-type: none"> ▪ Site: A 29-bed critical care unit with private rooms in a large Midwestern teaching hospital ▪ Sample: 20 coronary care patients 	<ul style="list-style-type: none"> ▪ Room conversation occurred most frequently followed by background sound, hall conversation, and environmental sound ▪ Sound levels were highest during room conversation and lowest for background sound ▪ Loudest environmental sounds came from furniture moving, alarms, and toilet flushing within the patients' rooms ▪ Heart rate levels increased during conversations ▪ Trait anxiety scores were not related to cardiovascular reactivity 	<ul style="list-style-type: none"> ▪ High sound levels were related to higher heart rate levels in certain instances ▪ No mention was made in regards to room occupancy, though it was mentioned that sound levels are probably lower on this unit with private rooms than on open intensive care units

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Baldwin, S. (1985, May)</p>	<ul style="list-style-type: none"> ▪ To evaluate the impact of furniture rearrangement on patients and on the ward atmosphere 	<ul style="list-style-type: none"> ▪ Furniture was rearranged into group seating arrangements in the ward dayrooms on 7 wards; Once a day at least 2 group seating arrangements were established ▪ The intervention followed the sequence of a baseline, intervention, a second baseline, and a second intervention; it lasted 8 weeks ▪ Variables measured were medication rates, seclusion rates, points earned, perception of the ward, and nursing reports 	<ul style="list-style-type: none"> ▪ Site: 7 male wards and 3 female wards in a maximum-security hospital in England ▪ Sample: Residents on the 10 wards; each ward has an average of 20 residents 	<ul style="list-style-type: none"> ▪ Trend exists toward overall decrease in seclusion in intervention wards ▪ A minor trend was discovered towards increased involvement in the ward program in the intervention wards ▪ Medication rates were stable across both wards ▪ The number of casualty incidents decreased on the intervention ward ▪ A greater number of points was earned by those on the intervention ward 	<ul style="list-style-type: none"> ▪ Moderate gains in the social interaction of patients in a maximum-security hospital can be achieved through short-term intervention ▪ No mention made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Baum, A. & Davis, G. E. (1980)</p>	<ul style="list-style-type: none"> ▪ To assess the effects of architectural intervention on residential crowding stress and poststressor effects 	<ul style="list-style-type: none"> ▪ Survey data was collected to measure feelings regarding dormitory life and feelings about the college ▪ Observational data was used to describe the effects of exposure to residential conditions on behavior in the dormitory ▪ Laboratory data was used to assess the persistence and generalizability of the effects of exposure to different residential conditions ▪ Intervention included adding more lounge space and reducing the number of residents along the corridor; floor housed 2 groups of 20 residents 	<ul style="list-style-type: none"> ▪ Site: Dormitories of a small residential liberal arts college; 3 dormitories were used: standard long corridor, short corridor, and a long corridor that has been manipulated ▪ Sample: 67 female residents living in the dormitory completed questionnaires; 54 subjects participated in laboratory component 	<ul style="list-style-type: none"> ▪ Residents residing on the standard long corridor reported more crowding and control-related problems and less small group development ▪ Long corridor residents reported less perceived control, increased difficulty in regulating social contact, dormitory life more hectic and less controllable, and less confidence in ability to control settings ▪ Less social activity observed on the long-corridor ▪ Residents on the altered long corridor were more confident in their ability to control events, less withdrawn, and engaged in more social interaction ▪ Residents of the short corridor and altered corridor experienced less stress and less crowding than those on the long corridor 	<ul style="list-style-type: none"> ▪ Decreased residential group size on the altered long corridor prevented symptoms of stress, withdrawal, and helplessness ▪ Findings related to specific room occupancy were not mentioned

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Beauchemin, K. M. & Hays, P. (1996)	<ul style="list-style-type: none"> ▪ To determine if the recovery of depressed patients is affected by their placement in brighter or darker rooms 	<ul style="list-style-type: none"> ▪ Data was abstracted from admission records over a two-year period in terms of the patient's diagnosis and length of stay 	<ul style="list-style-type: none"> ▪ Site: A psychiatric inpatient unit in Edmonton, Alberta ▪ Sample: 174 patients that had been admitted and discharged 	<ul style="list-style-type: none"> ▪ Length of stay was shorter for patients in brightly lit rooms; trend was more marked in males 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy
Becher, C. (1998, March 12)	<ul style="list-style-type: none"> ▪ To determine the view patients had of mixed-sex wards 	<ul style="list-style-type: none"> ▪ Questionnaires regarding the patients view on the mixed-sex ward, their age, sex, length of stay, and specialty were mailed out after discharge 	<ul style="list-style-type: none"> ▪ Site: Seven surgical wards at Southmead Hospital, Bristol ▪ Sample: 87 patients (64 on mixed-sex wards and 23 on single-sex wards) 	<ul style="list-style-type: none"> ▪ The majority of men did not have a preference for either ward ▪ The majority of women preferred a single-sex ward ▪ Gynecology patients were most in favor of a same-sex ward, though most other patients undergoing various types of surgeries preferred same-sex wards too ▪ Patients with previous experience of mixed-sex wards were more tolerant of them ▪ Single-day cases preferred same-sex wards; patients with longer stays were more tolerant of mixed-sex wards 	<ul style="list-style-type: none"> ▪ Most patients, especially women and those in for 1-day cases were in favor of single-sex wards ▪ No mention made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Brown, C., Arnetz, B., & Petersson, O. (2003)	<ul style="list-style-type: none"> ▪ To investigate the views of staff members of their work environment, their health, and the quality of care they delivered during a period of downsizing 	<ul style="list-style-type: none"> ▪ Longitudinal correlational design ▪ Staff opinions of the quality of care delivered and features of the work environment were measured over a period of years of hospital downsizing 	<ul style="list-style-type: none"> ▪ Site: tertiary care facility in Sweden ▪ Sample: Doctors and nurses who completed the questionnaires 	<ul style="list-style-type: none"> ▪ Quality of care was rated similarly prior to and after the downsizing occurred ▪ Staff perceptions of work environment during the downsizing was affected; scores were lower during this period ▪ Perceptions of workload increased after the downsizing was complete 	<ul style="list-style-type: none"> ▪ No mention was made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Burden, B. (1998)	<ul style="list-style-type: none"> ▪ To observe the strategies women in a maternity ward use to preserve their privacy 	<ul style="list-style-type: none"> ▪ Subject information was obtained through personal records in regards to type of delivery, method of feeding, antenatal week or postnatal day, and their position in the ward ▪ Discussions were held with patients over 12 visits in regards to their actions and views on why they and other women had drawn curtains around their beds 	<ul style="list-style-type: none"> ▪ Site: A maternity ward in England ▪ Sample: All women within the ward, excluding those on their first day following a Caesarian section 	<ul style="list-style-type: none"> ▪ Three strategies were discovered in terms of the position of the curtains: complete closure, semi-closure, and private closure; complications were a factor in the amount of closure used ▪ Complete closure was used to withdraw or to change clothes or sanitary towels ▪ Semi-closure was used to gain attention of staff, to get solitude, or to feed child ▪ Partial closure used most often throughout the day to get some rest or to read 	<ul style="list-style-type: none"> ▪ Women used to curtains around their beds to dictate the amount of privacy they wanted; Most only partially closed their curtains, but others who felt inadequate around others tended to use full closure of their curtains

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Cleary, T. A., Clamon, C., Price, M., & Shullaw, G. (1988)</p>	<ul style="list-style-type: none"> ▪ To describe the effects of a reduced stimulation unit on patient care 	<ul style="list-style-type: none"> ▪ Pretest-posttest design used ▪ A reduced stimulation unit was created to reduce the level of patient stimulation and minimize their reliance on memory ▪ Staff, family members, and visitors were educated in effective techniques to use with patients ▪ Patients were assessed through observations and interviews; family members filled out a satisfaction questionnaire; nurses were given a questionnaire assessing job satisfaction 	<ul style="list-style-type: none"> ▪ Site: Oaknoll Retirement Residence in Iowa City, Iowa ▪ Sample: 11 patients on the new unit 	<ul style="list-style-type: none"> ▪ The majority of patients who had been losing weight prior to the opening of the new unit had now reversed the trend ▪ Levels of patient agitation significantly decreased ▪ Family members reported increased satisfaction; patients were more calm, serene, and less agitated ▪ Nurse satisfaction did not change 	<ul style="list-style-type: none"> ▪ Patients benefited from the creation a unit with reduced stimulation ▪ No mention was made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
D'Atri, D. A. (1975, June)	<ul style="list-style-type: none"> ▪ To measure if a correlation exists between degree of crowding and blood pressure levels in an enforced crowded environment 	<ul style="list-style-type: none"> ▪ Data was collected by interviewers using standardized questionnaires ▪ Data collected included demographic and subcultural data, personal characteristics, mode of housing, confinement history, and blood pressure 	<ul style="list-style-type: none"> ▪ Site: 3 correctional institutes, each with different modes of housing including single cell, double-occupancy cells, or larger dormitories ▪ Sample: Inmates in the correctional facilities 	<ul style="list-style-type: none"> ▪ On average, blood pressure was higher for inmates in dormitory cells ▪ Factors associated with blood pressure levels were anxiety which increased blood pressure during the first 241 Twtectiona cella6ha first 	

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Flaherty, J. H., Tariq, S., Srinivasan, R., Bakshi, S., Moinuddin, A., & Morley, J. E. (2003)</p>	<ul style="list-style-type: none"> ▪ To assess a new model of treating elderly patients with delirium 	<ul style="list-style-type: none"> ▪ Hospital database reviewed for patients discharged from the delirium room in the acute care for the elderly unit (4-bed unit with constant monitoring) ▪ Data included activities of daily living, demographic information, and the amount of medication taken by patients 	<ul style="list-style-type: none"> ▪ Site: Saint Louis University Hospital ▪ Sample: 69 patients 	<ul style="list-style-type: none"> ▪ No physical restraints were used on patients in the Delirium Room ▪ Use of medication of patients similar to or lower than that found in previous studies ▪ Use of sedatives was less than 10% ▪ Mortality was zero ▪ Patients were functional and achieved early mobilization 	<ul style="list-style-type: none"> ▪ Patients suffering from delirium appear to benefit from constant nursing care in a multi-bed room
<p>Gotlieb, J. B. (2002)</p>	<ul style="list-style-type: none"> ▪ To discuss the relationship between patient hospital satisfaction and their hospital rooms as well as their evaluation of nurses and locus of causality 	<ul style="list-style-type: none"> ▪ Questionnaires were mailed to patients who had been discharged from the hospital ▪ Measures included patient satisfaction, patients' evaluation of their nurses and their rooms and patient perception of locus of causality 	<ul style="list-style-type: none"> ▪ Site: Large hospital in a major metropolitan area ▪ Sample: 232 patients discharged from the hospital 	<ul style="list-style-type: none"> ▪ Patients' evaluation of their rooms affected their evaluation of their nurses and their hospital satisfaction ▪ Patients' evaluation of their nurses affected their hospital satisfaction ▪ Patients' locus of causality affected their evaluation of their nurses 	<ul style="list-style-type: none"> ▪ Proper staffing of skilled nurses and a positive environment in patients' hospital rooms can increase patient satisfaction ▪ No mention made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Gotlieb, J. B. (2000)</p>	<ul style="list-style-type: none"> ▪ To investigate whether a relationship exists between the patient's hospital rooms and their perception of nurses on their perception of hospital quality 	<ul style="list-style-type: none"> ▪ Questionnaires were sent to patients ▪ Measures included patients' expectations of and their perceptions of their rooms and their nurses, as well as the amount of control they felt they had and 	<ul style="list-style-type: none"> ▪ Site & Sample: 232 patients who had received care in a U. S. Hospital 	<ul style="list-style-type: none"> ▪ Patients' perception of their rooms affected their perception of their nurses and of overall hospital quality ▪ Patients' perception of control affected their perception of their nurses but not the overall quality of the hospital ▪ Patients' perception of their nurses affected their overall perception of the quality of the hospital 	<ul style="list-style-type: none"> ▪ Patients' perception of their rooms impacts both their perceptions of the nurses and the hospital; care should be taken in designing the rooms ▪ No mention was made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Harris, P. B., McBride, G., Ross, C., & Curtis, L. (2002, June)</p>	<ul style="list-style-type: none"> ▪ To investigate the relative contribution of environmental satisfaction to overall satisfaction with the hospital experience ▪ To determine sources of environmental satisfaction within the hospital setting ▪ To examine differences in satisfaction levels among various hospital departments 	<ul style="list-style-type: none"> ▪ Telephone interviews were conducted with patients ▪ Open-ended questions related to satisfaction with the hospital room and satisfaction with the environment outside the room ▪ The Patient Perceptions of Quality Interview-Inpatient form was used to determine patients' perceptions of the overall quality of care and services received 	<ul style="list-style-type: none"> ▪ Site: Six different hospitals owned by IHC (2 small, 2 midsize, and 2 large facilities were used) ▪ Sample: 380 inpatients 	<ul style="list-style-type: none"> ▪ Nursing care was the strongest predictor of overall satisfaction followed by perceived quality of clinical care, environmental satisfaction, and satisfaction with admitting procedures ▪ Five major sources of satisfaction with the patient room: interior design features, architectural features, social features, maintenance/ housekeeping, and ambient environment ▪ Satisfied patients had a room where the features were easily accessible, had a window with a view, had larger rooms ▪ Patients satisfied with the social features of the room had a private room or had privacy protected ▪ For the most part, patients were satisfied with their rooms ▪ Participants suggested that hospital design should include private rooms that have a window with a view, room to accommodate visitors, and bathrooms 	<ul style="list-style-type: none"> ▪ Patients suggested that rooms should have accessible features ▪ Room design should be private with amenities such as a bathroom, a window with a view, and space to accommodate visitors

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Hays, P. & Beauchemin, K. B. (1998, October)</p>	<ul style="list-style-type: none"> ▪ To describe the effects of a sunny room on patients with myocardial infarction 	<ul style="list-style-type: none"> ▪ Natural experiment ▪ Outcomes of patients treated in sunny versus dull rooms were compared retrospectively based on fatal outcomes and length of stay over 4 years ending in March 1996 	<ul style="list-style-type: none"> ▪ Site: A cardiac intensive care unit in Edmonton, Canada ▪ Sample: 568 patients admitted directly to the cardiac intensive care unit with a first attack of myocardial infarction 	<ul style="list-style-type: none"> ▪ The average length of stay for all patients was 2.46 days ▪ Light does have an effect on length of stay ▪ Men stayed an average of 2.3 days in sunny rooms and an average of 2.6 days in dark rooms ▪ Women stayed an average of 2.3 days in sunny rooms and 3.3 days in dark rooms ▪ Deaths were more frequent on the dark side 	<ul style="list-style-type: none"> ▪ The amount of light in a room does impact a patient's stay ▪ No mention made in regards to room occupancy
<p>Higgs, P. F., MacDonald, L. D., & Ward, M. C. (1992)</p>	<ul style="list-style-type: none"> ▪ To determine patients' views in regards to their stay in long-term geriatric wards 	<ul style="list-style-type: none"> ▪ Patients were assessed for performance status and levels of confusion ▪ Patients were then interviewed about their views of life in the long-stay ward 	<ul style="list-style-type: none"> ▪ Site: Long-stay institutions in the South West Thames region ▪ Sample: 291 long-stay patients in the South West Thames region 	<ul style="list-style-type: none"> ▪ The majority of patients were satisfied with their relations with the medical, nursing, and other staff ▪ Most patients were satisfied with their degree of autonomy ▪ Most patients did not feel lonely ▪ The majority of the patients found the staff and care received were the best thing about the institution 	<ul style="list-style-type: none"> ▪ On the whole, patients were satisfied with the care received at long-term care facilities ▪ No mention made in regards to room occupancy

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Hilton, B. A. (1985)	<ul style="list-style-type: none"> ▪ To determine sources of sound, levels of sound, patient perceptions of sound, and which types of sounds can be modified in acute patient care areas 	<ul style="list-style-type: none"> ▪ Exploratory and descriptive design ▪ Continuous recording of sound levels made in proximity of each patient over a 24-hour period ▪ Participants provided oral answers to a questionnaire which asked patients how noise affected them and whether or not they found the noise levels acceptable 	<ul style="list-style-type: none"> ▪ Site: Three hospitals (one large, one small teaching, and one small community) in a large metropolitan area in Northwest Canada; four intensive care units and two general care units were used for this study ▪ Sample: 25 patients; 4 to five patients from each unit; convenience sample used 	<ul style="list-style-type: none"> ▪ The critical and noncritical areas were quieter in the two smaller hospitals ▪ Levels of talking by staff, patients, and visitors were louder on all units than necessary ▪ Sound levels dropped at night in all units except the recovery room and intensive care unit in the large hospital ▪ Steady sounds included oxygen, chest-tube bubbling, and ventilator functioning ▪ Patients were satisfied with noise levels in the pre-and postoperative ward of the large hospital, the medical wards and intensive care units in the teaching hospital, and the intensive care unit of the small community hospital ▪ Sound levels generated outside of the room were reduced when the patient's door was closed ▪ Differences in noise levels between the large hospital's intensive care unit and recovery room and the intensive care units of the small hospitals appear related to room size; the small hospital consisted of private rooms while the large hospital consisted of two rooms with two to eight patients per room 	<ul style="list-style-type: none"> ▪ Sound levels appear to be related to room size in that they were lower in rooms with single occupancy rather than multiple occupancy rooms

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Holahan, C. J. & Saegert, S. (1973)	<ul style="list-style-type: none"> ▪ To investigate the relationship between ward design and patient behavior on two hospital wards 	<ul style="list-style-type: none"> ▪ Design was posttest control group ▪ Wards were selected based on how well matched they were on selected criteria ▪ One ward was remodeled during a 4-week period; purpose was to improve ward atmosphere ▪ Experimental measures collected 6 months after remodeling occurred during a 5-week period ▪ Patients were observed and interviewed 	<ul style="list-style-type: none"> ▪ Site: One remodeled and one original ward at the City University of New York Hospital ▪ Sample: 25 patients on each ward 	<ul style="list-style-type: none"> ▪ Significantly more socializing and less passive behavior occurred on the remodeled ward ▪ On the remodeled ward, there was a trend towards greater socialization in the bedrooms than in the control ward; the bedrooms were of the dormitory type but on the remodeled ward, partitions were installed creating a number of 2-bed sections ▪ Attitudes were more positive towards the physical environment on the remodeled ward 	<ul style="list-style-type: none"> ▪ A well-designed physical environment can facilitate recovery ▪ Rooms were shared occupancy and a trend towards greater socialization was noticed on the remodeled ward, though explanations were not given as to why this trend may have occurred
Ittelson, W. H., Proshansky, H. M., & Rivlin, L. G. (1970, December)	<ul style="list-style-type: none"> ▪ To determine the impact that bedroom size has on the behavior of patients 	<ul style="list-style-type: none"> ▪ Observations of patients were made using a time-sample approach ▪ The location, participants, time, and nature of activity on the ward were recorded ▪ Bedrooms of patients were mainly single- and double-occupancy; 1 4-bed room was located on each ward 	<ul style="list-style-type: none"> ▪ Site: The psychiatric wards of three large metropolitan hospitals; they are private, city, or state hospitals ▪ Sample: Patients on the wards 	<ul style="list-style-type: none"> ▪ Isolated passive behavior is most frequent in all bedrooms ▪ As the number of patients in the room increases, isolate passive behavior increases ▪ Social behavior decreases with increased bedroom size 	<ul style="list-style-type: none"> ▪ The smaller rooms, with less occupants, provide the patients with the greatest freedom of choice for activities

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Janssen, P. A., Harris, S. J., Soolsma, J., Klein, M. C., & Seymour, L. C. (2001, September)	<ul style="list-style-type: none"> ▪ To evaluate the responses of nurses prior to and after working in a single room maternity ward in comparison to working in a traditional maternity ward 	<ul style="list-style-type: none"> ▪ Nurses planning to work on the new single room ward completed surveys 6 months prior to opening the ward and three months after the ward opened ▪ Questions measured nurses' perception of the physical setting, quality of care, perceived competence, and the nursing practice environment 	<ul style="list-style-type: none"> ▪ Site: BC Women's Hospital in Vancouver, Canada ▪ Sample: 20 single room maternity care nurses, 26 delivery suite nurses, and 26 postpartum nurses 	<ul style="list-style-type: none"> ▪ Physical space was more spacious in the single rooms and equipment and supplies were more easily accessible than in the delivery suite; privacy was also increased and noise levels decreased in the single rooms ▪ Nurses were better able to respond to the physical, emotional, and spiritual needs of the patients in the single rooms ▪ Nurses felt more accountable for their decisions in the single rooms and they felt highly competent ▪ Medical staff was less readily available in the single room unit ▪ Job satisfaction increased on the single room wards 	<ul style="list-style-type: none"> ▪ Nurses preferred the single room maternity unit
Kulik, Moore, & Mahler (1993)	<ul style="list-style-type: none"> ▪ To determine effects of roommate on anxiety levels of patients ▪ To look at interaction patterns of preoperative patients and their roommates 	<ul style="list-style-type: none"> ▪ Evening prior to surgery, patients approached and asked to complete questionnaire dealing with opinions & experiences as a surgical patient in a hospital 	<ul style="list-style-type: none"> ▪ Site: San Diego Veterans Administration hospital ▪ Sample: 53 men undergoing non-emergency surgeries (hernia, open-heart (valve), bladder/prostate) 	<ul style="list-style-type: none"> ▪ Anxiety significantly higher for preoperative patients assigned to a preoperative roommate compared to a postoperative or non-surgical roommate ▪ Patients talked significantly more to preoperative rather than postoperative or non-surgical roommates ▪ Patient's preoperative anxiety and affiliation levels were unrelated 	<ul style="list-style-type: none"> ▪ Practical benefit to assigning preoperative patients to postoperative or non-surgical roommates; semi-private room beneficial for pre-operative patient

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Lawson, B. & Phiri, M. (2000)	<ul style="list-style-type: none"> ▪ To address patient satisfaction in relation to their hospital surroundings 	<ul style="list-style-type: none"> ▪ Patients were surveyed over 3 months in regards to their condition, treatment, and health outcomes ▪ Comparisons were made between orthopedic patients treated in a refurbished ward at Poole Hospital versus those treated in a conventional in the same hospital ▪ Comparisons were also made between psychiatric patients in a purpose-built ward at Mill View hospital with those on two wards at Brighton General Hospital ▪ Patients were also given a questionnaire upon discharge which dealt with their hospital stay 	<ul style="list-style-type: none"> ▪ Site: Poole Hospital, Mill View Hospital, & Brighton General Hospital in England ▪ Sample: 237 patients at Poole Hospital and 151 at Mill View Hospital and Brighton General Hospital 	<ul style="list-style-type: none"> ▪ Patients in the newer buildings and wards rated their experience and treatment higher than those in the older wards ▪ Those in the newer buildings were more satisfied with the appearance, layout and overall design of the ward ▪ The psychiatric patients at Mill View were discharged more quickly and spent less time in intensive care than those in the old building ▪ Fewer analgesics were used on orthopedic patients on the newer ward 	<ul style="list-style-type: none"> ▪ Hospital design impacts patient satisfaction in regards to their treatment and the facility ▪ Patients treated in single rooms were more satisfied than those treated in multiple-bed wards

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<p>Leigh, H., Hofer, M. A., Cooper, J. & Reiser, M. F. (1972)</p>	<ul style="list-style-type: none"> ▪ To compare the psychological states of patients in a Coronary Care Unit with multiple-room occupancy versus single-room occupancy 	<ul style="list-style-type: none"> ▪ Patients who were willing were approached and were interviewed and were given surveys to complete in regards to their perceptions of the Coronary Care Unit as well as their degree of depression, anxiety, agitation, and hostility ▪ Patient interactions were monitored and their medical charts were reviewed to compare their medical course 	<ul style="list-style-type: none"> ▪ Site: Two Coronary Care Units in a general hospital in the U. S.; one unit contained multiple occupancy rooms (open) while the other contained only single occupancy rooms (closed) ▪ Sample: 66 patients (33 on each unit) 	<ul style="list-style-type: none"> ▪ Patient-patient interaction was higher in the open ward ▪ Separation anxiety was higher on the closed unit and patients felt more lonely ▪ Patients in the open ward experienced higher levels of shame anxiety 	<ul style="list-style-type: none"> ▪ On the closed unit, privacy increased but interaction decreased and patients felt lonely ▪ Patients on the open unit had more social contact with others and felt they could express their hostility openly; lack of privacy led to higher levels of shame anxiety

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<p>Martin, D. P., Diehr, P., Conrad, D. A., Davis, J. H., Leickly, R. & Perrin, E. B. (1998)</p>	<ul style="list-style-type: none"> ▪ To compare patient outcomes on the Planetree Model Hospital Unit with other medical-surgical units in the hospital regarding satisfaction, education, involvement in care, health behavior and compliance, health status, and use of services 	<ul style="list-style-type: none"> ▪ Patients were interviewed for 20 minutes at admission; They were then asked to fill out questionnaires 1 week, 3 months, and 6 months after discharge ▪ Limitations: selection bias between groups; self reports could increase chance of social desirability in responses; new scales used which could have lower reliability and validity 	<ul style="list-style-type: none"> ▪ Site: San Francisco Hospital ▪ Sample: Patients 18 and older randomly assigned to 2 wards ▪ 315 were Planetree patients; 445 were on other medical units 	<ul style="list-style-type: none"> ▪ Planetree patients: significantly more satisfied with hospital stay and with unit's environment and architecture; greater opportunity to see family and friends and to interact with other patients; learned more about illness and self-care; satisfied with education received; more likely to receive written information regarding condition and treatment ▪ No differences were found in regards to physician involvement or patient control over coping strategies ▪ Long-term outcome similar for both sets of patients 	<ul style="list-style-type: none"> ▪ With the proper environment and education, patients' experience in the hospital is positive, regardless of room occupancy.

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<p>Matthews, E. A., Farrell, G. A., & Blackmore, A. M. (1996)</p>	<ul style="list-style-type: none"> ▪ To determine if a client-centered approach affects agitation levels and sleep patterns in patients suffering from dementia 	<ul style="list-style-type: none"> ▪ Data was collected over four phases, each lasting four weeks ▪ Levels of patients sleep and agitation were measured prior to and after the environmental manipulation of client-centered care occurred 	<ul style="list-style-type: none"> ▪ Site: 44-bed dementia ward in a nursing home in Perth, Australia ▪ Sample: 33 residents of the dementia ward 	<ul style="list-style-type: none"> ▪ 11 agitation behaviors were common to at least 20% of patients throughout the study period ▪ Verbal agitation significantly decreased during the day shift when the intervention was introduced, but it increased significantly during the late shift ▪ Daytime sleep increased during the first phase of the intervention but returned to pre-intervention levels by the end of the study 	<ul style="list-style-type: none"> ▪ No mention was made in regards to room occupancy
<p>Milne, D. & Day, S. R. (1986)</p>	<ul style="list-style-type: none"> ▪ To examine factors that impact the patients' and nurses' perspectives of ward atmosphere 	<ul style="list-style-type: none"> ▪ Nurses and patients completed the Ward Atmosphere scale at 2 baseline phases and then post-intervention ▪ 2 versions of the scale (real and ideal) were given to measure patient and nurse satisfaction ▪ Staff were trained on implementing a revised therapeutic program to acute patients; they were trained in behavior therapy and anxiety management 	<ul style="list-style-type: none"> ▪ Site: National Health Service psychiatric day hospital ▪ Sample: Staff (6) and patients (41) of the day hospital 	<ul style="list-style-type: none"> ▪ Nurses' and patients' perspectives of the ward atmosphere increased after the intervention was put into place ▪ The effect was only noticeable in acute patients and not chronic patients, who did not receive the intervention 	<ul style="list-style-type: none"> ▪ Improvements to the therapeutic program and to nurse training can aid in making the ward atmosphere more positive ▪ No mention made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Morgan, D. & Stewart, N. (1999, January)	<ul style="list-style-type: none"> ▪ To describe the relationship between environment and behavior in dementia care settings 	<ul style="list-style-type: none"> ▪ Following completion of a new building, patients were moved from an existing high-density Special Care Unit (SCU) to new low-density Special Care Unit ▪ Patients had larger, private rooms in new SCU; old SCU contained smaller, multiple occupancy rooms ▪ Interviews of staff and family members took place 3 months after patients were moved; questions were asked regarding their impressions of the new unit 	<ul style="list-style-type: none"> ▪ Site: 286-bed long-term care facility ▪ Sample: 4 registered nurses, 5 resident attendants, and 9 family members 	<ul style="list-style-type: none"> ▪ Staff found it more difficult to supervise patients because of corridor design; resident safety was a concern ▪ The old SCU was seen as happier because of the closer proximity and busy environment; felt like a family ▪ New SCU more institutional because of lower density and decrease in activities; rooms felt more like home though because more chance to personalize them ▪ Significant decrease in disruptive behavior on new SCU unit ▪ Private bedrooms evaluated positively; more privacy given ▪ Less interaction occurred on new unit because of greater dispersion 	<ul style="list-style-type: none"> ▪ Overall, the new unit was evaluated positively ▪ Patients were given greater privacy and more space through their private bedrooms creating a comfortable, home-like environment

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<p>Nguyen, Briancon, Empereur, & Guillemin (2002)</p>	<ul style="list-style-type: none"> ▪ To identify factors associated with patient satisfaction 	<ul style="list-style-type: none"> ▪ Sociodemographic data and health status were collected on first day of hospitalization ▪ 2 weeks after discharge, patients were mailed questionnaire measuring patient satisfaction 	<ul style="list-style-type: none"> ▪ Site: Nancy University Hospital Center, France ▪ Sample: 684 patients with cardiovascular, respiratory, urinary, and locomotor diseases 	<ul style="list-style-type: none"> ▪ Most patients tended to rate hospital stay favorably ▪ Two strongest predictors of higher satisfaction were older age and better self-perceived health status ▪ Patients who stayed in private patient rooms were more satisfied with admissions, hospital environment and staff, information, and overall quality of care ▪ Patients who did not choose their hospital were twice as likely to complain about their stay 	<ul style="list-style-type: none"> ▪ Patients in private rooms were more satisfied with the hospital environment as a whole

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Pattison & Robertson (1996)	<ul style="list-style-type: none"> ▪ To examine effect of ward design on patients' experience of hospital and their well-being ▪ To measure patient preference in hospital design 	<ul style="list-style-type: none"> ▪ Administered detailed questionnaire to patients through individual interviews on 5th post-operative day 	<ul style="list-style-type: none"> ▪ Site: 2 gynecological wards in United Kingdom hospital ▪ Sample: 64 female patients (32 on Nightingale ward, 32 on Bay ward) 	<ul style="list-style-type: none"> ▪ Nightingale ward: better contact with nurses, higher noise levels, higher sleep disturbances, more privacy ▪ Bay ward: concerned with lack of contact with nurses, lack of auditory privacy, disturbing noises ▪ 75% of patients preferred bay ward 	<ul style="list-style-type: none"> ▪ Neither ward overwhelmingly better ▪ Bay ward preferred, but could be improved
Peltier, J. W., Schibrowsky, J. A., & Cochran, C. R. (2002, Summer)	<ul style="list-style-type: none"> ▪ To determine if the nurse-patient and physician-patient interactions impact patient loyalty and care quality 	<ul style="list-style-type: none"> ▪ Questionnaires were mailed to patients; items included nurse-related and physician-related questions and measures of quality of care and loyalty 	<ul style="list-style-type: none"> ▪ Site: Large metropolitan hospital ▪ Sample: 193 obstetric patients from previous 12 months 	<ul style="list-style-type: none"> ▪ Quality of care and loyalty are a function of wide range of nurse and physician performance variables ▪ Quality of care function of physician-patient communications, nurse-patient communications, and physician-patient social interactions ▪ Loyalty a function of amount of decision-making control allotted by physicians 	<ul style="list-style-type: none"> ▪ Patients' quality of care and their loyalty toward the hospital is dependent upon the care given to them by their physicians and nurses as well as the amount of control given to them ▪ No mention made in regards to room occupancy

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Rogers, S. (2001/2002, Winter)	<ul style="list-style-type: none"> ▪ To address the issue of a mixed gender ward and its impact on patient transfers, patient admissions, staff reactions, and financial costs 	<ul style="list-style-type: none"> ▪ Patients filled out surveys in regards to acceptance of mixed gender rooms ▪ Nursing staff filled out surveys in regards to beliefs regarding mixed gender rooms ▪ Data transfers for November 2000 were reviewed to measure costs incurred with patient transfers 	<ul style="list-style-type: none"> ▪ Site: University Health Network in Toronto (Toronto General, Toronto Western, Princess Margaret) ▪ Sample: 116 patients from these 3 hospitals were surveyed; 31 front-line staff responded to survey as did 27 nurse managers 	<ul style="list-style-type: none"> ▪ If these hospitals eliminated same gender wards, they would save from \$58,880 to \$277,200; about 8-10% of all transfers in these facilities are due to gender issues ▪ Savings in transfers only occur, however, if patients are not moved again to same gender rooms ▪ 65% of patients would accept placement in mixed gender ward; it increased to 76% if placement in mixed gender ward would result in faster admission ▪ 81% of nurses and 63% of nurse managers thought mixed gender wards were not a good idea; 68% of nurses and 67% of nurse managers thought mixed gender wards would make working more difficult 	<ul style="list-style-type: none"> ▪ Patients would generally accept a mixed-gender room arrangement, especially if it meant faster admission; nurses did not approve of mixed-gender arrangements

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<p>Singer, A. J., Sanders, B. T., Kowalska, A. Stark, M. J., Mohammad, M. & Brogan, G. X. (2000, January)</p>	<ul style="list-style-type: none"> ▪ To measure the effect of a bedside television set on patient satisfaction 	<ul style="list-style-type: none"> ▪ A prospective, randomized, controlled, unblinded clinical trial was used ▪ A trained research assistant recorded patient information on a structured closed-question data sheet ▪ Patient satisfaction as well as their length of stay was measured through a 100-mm visual analogue scale and Likert-type scale 	<ul style="list-style-type: none"> ▪ Site: The emergency room of a suburban tertiary care center ▪ Sample: 181 patients; 77 were assigned to a room with a bedside TV; 104 were assigned to a room without bedside TVs 	<ul style="list-style-type: none"> ▪ Patient satisfaction the same regardless of whether or not TV was in room ▪ Patients who stayed longer than expected were less satisfied with hospital than those who stayed the same or less than expected 	<ul style="list-style-type: none"> ▪ It appears that bedside television sets did not affect patients' overall satisfaction levels ▪ No mention made in regards to room occupancy

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Spaeth, G. L. & Angell, M. F. (1968)	<ul style="list-style-type: none"> ▪ To investigate the preference for multi-bed or private rooms among ophthalmic patients 	<ul style="list-style-type: none"> ▪ Patients admitted or discharged from the facility between May 4 and June 2, 1967 were included ▪ Patients were asked to complete a questionnaire upon admission; information requested included age, sex, if the patient had been previously hospitalized, their opinion of their visual ability, and their preference for room type ▪ Patients discharged during this time were also given a similar form to complete 	<ul style="list-style-type: none"> ▪ Site: Wills Eye Hospital, Philadelphia ▪ Sample: 254 admission patients and 376 discharged patients 	<ul style="list-style-type: none"> ▪ At time of admission, majority of patients preferred multi-bed room ▪ Most important determinant of room preference was previous history of hospitalization; patients who had not been hospitalized previously preferred single rooms; multi-bed rooms were nine times as popular among patients who were previously hospitalized ▪ After their hospitalization at this facility, fewer patients wanted single rooms and significantly more patients wanted multi-bed rooms ▪ Degree of sensory deprivation did not influence feeling of need for assistance by roommates ▪ Economic factors were not important in determining room preference 	<ul style="list-style-type: none"> ▪ Most ophthalmic patients preferred multi-bed rooms to single-occupancy rooms

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Thompson, J. D. & Goldin, G. (1975)	<ul style="list-style-type: none"> ▪ To determine what patients prefer in terms of their hospital rooms during their hospital stay 	<ul style="list-style-type: none"> ▪ Patients were interviewed in regards to their hospital rooms; interviews were used to evaluate the patient's preference for hospital rooms ▪ Interviews were completed during the patient's hospital stay 	<ul style="list-style-type: none"> ▪ Site: Yale-New Haven Hospital and Genesee Hospital in Rochester, New York ▪ Sample: 505 patients; patients at Genesee hospital were all in single-occupancy rooms; patients at Yale-New Haven hospital were in single- and multiple-occupancy rooms 	<ul style="list-style-type: none"> ▪ The majority of patients at Yale-New Haven hospital liked the windows the most in terms of specific features of their rooms ▪ Patients at Genesee Hospital liked seeing into the corridor (beds were placed facing the corridor, not the window) ▪ Sense of security most important feature hospital can offer ▪ Patients in 4-bed rooms at Yale-New Haven were bothered by the other patients and their visitors 	<ul style="list-style-type: none"> ▪ The patients' room occupancy preference was not studied directly, but patients in the 4-bed rooms were bothered by the other patients in their rooms

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Topf. M. (1985, Fall)	<ul style="list-style-type: none"> ▪ To examine the impact of noise on a patient's health as well identify the mechanism that links noise-induced stress with coping and health 	<ul style="list-style-type: none"> ▪ Subjects were randomly assigned to a group that received instruction for control over hospital noise or to a control group ▪ Questionnaires were used to measure objective noise, sensitivity of a person to noise, the degree of stress caused by hospital sounds, social desirability, and coping with noise ▪ Seriousness of illness was measured by time spent in surgery ▪ Self-report measures were used to determine health outcomes ▪ Data was collected over an eight-month period 	<ul style="list-style-type: none"> ▪ Site: large metropolitan Veterans Administration Hospital ▪ Sample: 150 male surgery patients 	<ul style="list-style-type: none"> ▪ Objective noise, greater sensitivity of the person to noise, and greater noise-induced stress were related to greater exercised control over noise by patients ▪ Those with greater sensitivity to noise were more likely to use coping strategies regardless of the level of objective noise ▪ Patients used cognitive strategies to control hospital noise ▪ Older patients exercised less control over hospital noise ▪ Instruction in control over noise did not predict greater coping strategies 	<ul style="list-style-type: none"> ▪ No mention was made in regards to room occupancy

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<p>Tyson, G. A., Lambert, G., & Beattie, L. (2002)</p>	<ul style="list-style-type: none"> ▪ To determine the effect of ward design on nurses in a psychiatric ward 	<ul style="list-style-type: none"> ▪ Observations of nurses' behaviors were made six months prior and six month after moving to a new ward (acute and long-stay) ▪ Measures included interaction with patients, interactions with staff, tasks completed and other duties ▪ Questionnaires were mailed to nurses measuring level of burnout and personal accomplishment, emotional exhaustion, and depersonalization towards patients ▪ Staff was interviewed in regards to their views of the new ward 	<ul style="list-style-type: none"> ▪ Site: Rural psychiatric hospital in Australia ▪ Sample: 40 nurses from the old ward and 40 nurses for the new ward 	<ul style="list-style-type: none"> ▪ Increased burnout occurred in the new ward ▪ New ward thought to be more aesthetic and pleasing as well as better for patients because of increased privacy (especially on long-stay ward where rooms were private) ▪ The new facilities were thought to be cramped and nursing offices too small ▪ The new acute ward had the most positive outcomes with increased staff-patient interactions in terms of amount and quality ▪ The increased space and privacy on the acute ward made it more difficult to find and observe patients; large space also made staff feel more isolated 	<ul style="list-style-type: none"> ▪ The evaluations of the new ward were both positive and negative for the nurses; while patients benefited from increased space and privacy, nurses suffered from increased burn-out, especially in the long-term stay unit ▪ The new long-stay ward contained all private rooms which increase patient privacy; the new acute ward contained a mixture of private and multiple occupancy rooms-space and privacy was also increased for these patients

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Ulrich, R. S. (1984, April 27)	<ul style="list-style-type: none"> ▪ To determine whether having a room with a window view of a natural setting impacts the recovery of patients 	<ul style="list-style-type: none"> ▪ Records were obtained for patients who were assigned to the 2nd and 3rd floors of a 3-story hospital; information included length of stay, analgesics taken, minor complications, and nurses' notes ▪ The rooms patients stayed in either faced a brown brick wall or a small stand of trees; rooms were all double occupancy and nearly identical in all features besides their window view 	<ul style="list-style-type: none"> ▪ Site: A suburban Pennsylvania hospital ▪ Sample: 46 patients who had undergone cholecystectomy between 1972 and 1981 	<ul style="list-style-type: none"> ▪ Patients with the view of trees had shorter length of stays ▪ Analgesic doses were lower between the 2nd and 5th days of treatment for those with the view of trees ▪ Those with the view of trees received more positive comments from nurses 	<ul style="list-style-type: none"> ▪ The nature of the view patients have from their windows appears to have some effects on their recovery ▪ Rooms in the study were double occupancy, but the nature of the room occupancy was not discussed in terms of the findings

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
Verderber, S. (1986)	<ul style="list-style-type: none"> ▪ To determine the effect of windows on patient outcomes 	<ul style="list-style-type: none"> ▪ Photoquestionnaire was developed illustrating conditions in 11 hospitals that showed rooms from entirely windowless to having windows ▪ Patients were also asked to complete 10 written questions which were concerned with patient preference and ratings of satisfaction with windows in the patient's unit 	<ul style="list-style-type: none"> ▪ Site: Six hospitals in the physical medicine and rehabilitation units ▪ Sample: 125 staff members and 125 inpatients 	<ul style="list-style-type: none"> ▪ In looking at the photos, subjects preferred views of trees and lawns, the neighborhood surrounding the hospital, people 	

Study	Focus of Study	Research Design	Sample Information and Site	Findings	Relationship of findings to room occupancy
<p>Volicer, B. J., Isenberg, M. A., & Burns, M. W. (1977, June)</p>	<ul style="list-style-type: none"> ▪ To measure the difference in scores of psychosocial stress due to hospitalization between medical and surgical patients 	<ul style="list-style-type: none"> ▪ Interviews were conducted with medical and surgical patients ▪ Information obtained on patient background and their physical status as well as their scores on the Hospital Stress Rating Scale (HSRS) ▪ Patients contacted 2 weeks after discharge to report on physical status 	<ul style="list-style-type: none"> ▪ Site: Community Hospital ▪ Sample: 535 medical and surgical patients 	<ul style="list-style-type: none"> ▪ Age, number of previous hospitalizations, and number of years since last hospitalization correlate with stress scores ▪ Surgical patients reported higher stress than medical patients on factors pertaining to loss of independence, threat of severe illness, and unfamiliarity of surroundings ▪ Medical patients reported more stress in terms of financial problems and lack of information 	<ul style="list-style-type: none"> ▪ Surgical patients appear to report higher experience of stress in the hospital though surgical and medical patients differ in the factors they perceive stressful ▪ No mention made in regards to room occupancy

Non-Empirical Articles

Therapeutic impacts: Relationship Between Healing and Environment

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Anonymous. (2001, December)	<ul style="list-style-type: none"> ▪ To describe factors that impact patient satisfaction 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Nurses with negative attitudes can impact finances as customer satisfaction is low ▪ Communication between staff, patients, and their family members is important to patient satisfaction ▪ Employee morale impacts work ▪ Quick responses to patient complaints are beneficial ▪ Doctors want to feel appreciated and know that they have a competent staff ▪ Patient expectations must be managed 	<ul style="list-style-type: none"> ▪ By improving attitudes among hospital staff, patient satisfaction with their experience in the hospital may increase ▪ No mention made in regards to room occupancy
Biley, F. (1993, October 20)	<ul style="list-style-type: none"> ▪ To demonstrate how patient environments affect the patients' recovery 	<ul style="list-style-type: none"> ▪ Hospitals in England 	<ul style="list-style-type: none"> ▪ Hospital buildings of the 20th century were designed with more money being spent on technological advances than on design ▪ In recent years, more attention paid to aesthetic design of hospitals ▪ Designs include bright open spaces, use of natural light, and art ▪ Illustrations of natural scenes have positive effects on the mental and physical state of patients ▪ Cool colors should be used to promote relaxation while warm colors promote activity and neutral colors minimize attention ▪ Laws passed in North America stating that hospitals rooms should have windows or skylights to avoid delayed recovery 	<ul style="list-style-type: none"> ▪ Colors, art and lighting are important elements of design that can have positive effects on the well-being of patients ▪ No mention made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Cabrera, I. N. & Lee, M. H. M. (2000)	<ul style="list-style-type: none"> ▪ To propose a solution to reduce stress and anxiety in a hospital setting through the use of music therapy 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Use of a Sound Control Center in hospitals responsible for reducing extreme noise levels throughout the hospital and for providing a center of music therapy ▪ Music therapy can be used to help mask procedural sounds as well as reduce anxiety and alleviate pain 	<ul style="list-style-type: none"> ▪ Reduction of noise levels with appropriate use of music selection can help improve patients' health ▪ No mention of preference for single or multiple room occupancy
Davis, B. (2001, May 28)	<ul style="list-style-type: none"> ▪ To describe the Continuous Ambient Relaxation Environment (C.A.R.E) television channel 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Television channel is 24-hour and promotes relaxation and contributes to therapeutic environment ▪ Channel appeals to hospital officials that promote healing through building design and environmental cues ▪ Viewers are able to watch nature scenes accompanied by soundtrack with woodwinds and harp 	<ul style="list-style-type: none"> ▪ C.A.R.E. channel can help patients heal through its focus on nature and music ▪ No mention made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Fottler, M. D. (2000, March/April)	<ul style="list-style-type: none"> ▪ To examine the importance in determining patient satisfaction, promoting patient healing and well-being, and improving employee attitudes 	<ul style="list-style-type: none"> ▪ Hospitals in general 	<ul style="list-style-type: none"> ▪ A clean and safe environment that is easy to use can improve patients' satisfaction and the quality of their experience ▪ It is important for patients and their family members to feel their medical, psychological, and physical needs have been met ▪ Patient-focused design improves the personalization of service and provides for maximum opportunities for family interaction ▪ A clean, organized, and comfortable environment is beneficial to the needs of staff ▪ The patient's experience can be enhanced through the use of natural light, noise control, appropriate temperature, and attractive decor 	<ul style="list-style-type: none"> ▪ A well-designed setting can have a positive impact on staff members and can improve patient satisfaction and clinical outcome ▪ No mention is made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Hancock, T. (1999)	<ul style="list-style-type: none"> ▪ To examine ways in which hospitals can promote health 	<ul style="list-style-type: none"> ▪ Hospitals in general 	<ul style="list-style-type: none"> ▪ Healthy hospitals create a healing environment for patients, and a healthy workplace for staff ▪ The physical environment impacts the social and mental well-being of patients and the social environment can affect the physical state of patients ▪ Use of color, texture, and form and the creation of a homelike setting are important elements of design ▪ Role of plants and nature also important ▪ Patients and their family members should be active partners in the process of healing ▪ People who are at ease and rested in a nurturing environment will heal more rapidly 	<ul style="list-style-type: none"> ▪ Healthy environments help put the patient at ease and facilitate a rapid recovery ▪ No mention is made in regards to room occupancy
Hosking, S. & Haggard, L. (1999)	<ul style="list-style-type: none"> ▪ To describe aspects of hospitals that can improve patient conditions 	<ul style="list-style-type: none"> ▪ Hospitals in general 	<ul style="list-style-type: none"> ▪ Patients expect the treatment they receive should be appropriate for their condition ▪ Noise that a patient cannot tolerate is a source of stress; unpleasant sounds can be excused when deemed necessary ▪ Control of noise should be important; tolerance of noise is lower during illness ▪ Positive contribution of sense of smell is through use of aromatherapy and scented oils ▪ Efforts are made to preserve the patient's dignity; privacy increased ▪ Petting tame animals can reduce stress 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Leith, B. A. (1998, August)	<ul style="list-style-type: none"> ▪ To describe the effect that transfers have on patients 	<ul style="list-style-type: none"> ▪ Hospitals in general 	<ul style="list-style-type: none"> ▪ Separation anxiety can result in patients about to be transferred; patients may experience anxiety because of loss of close relationship with nurses and doctors ▪ Patients may also experience primary transfer anxiety which is related to the type and timing of the transfer and the disruption of interpersonal relationships ▪ Expectant transfer anxiety occurs when patients are not fully prepared for their transfer ▪ Patients that are uncertain may experience stress which can adversely affect their ability to cope with their illness; uncertainty can result due to a change in environment or routine ▪ Transfer anxiety is related to uncertainty caused by being separated from a familiar environment and can lead to stress and inability to cope ▪ Reasons for transfer anxiety include little or no preparation for the transfer, reduction in monitoring, loss of security, and lack of predictability in the new environment ▪ Symptoms of transfer anxiety include insecurity, vigilance, and withdrawal ▪ When patients were prepared for the transfer by nurses, they responded better to the transfer 	<ul style="list-style-type: none"> ▪ Transfer anxiety can adversely affect the coping ability of patients ▪ No mention was made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Nicholson, L. (1993)	<ul style="list-style-type: none"> ▪ To describe factors of the hospital environment that can aid the healing process 	<ul style="list-style-type: none"> ▪ Hospitals in general 	<ul style="list-style-type: none"> ▪ Emphasis of warm environment began in 1980's ▪ Hospital interior environments must create balance and harmony ▪ The hospital environment be humanized and respond to the physical, mental, emotional, and spiritual needs of the patients ▪ Patients should be given as much freedom and independence as possible ▪ Healing environment enables patient to have privacy; people desire flexibility to control their environment based on their needs ▪ Healing space should provide and encourage relaxation; windows provide access to the outdoors ▪ Patients should have space for their personal belongings ▪ Space should be provided for family members ▪ Pleasant surroundings help individuals to feel better 	<ul style="list-style-type: none"> ▪ No mention was made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Rich, M. (2002, November 27)	<ul style="list-style-type: none"> ▪ To describe how improvements in design have therapeutic effects for patients 	<ul style="list-style-type: none"> ▪ Barbara Ann Karmanos Cancer Institute, Detroit ▪ Methodist Hospital, Indianapolis ▪ Bronson Methodist Hospital, Kalamazoo, Michigan ▪ Swedish Medical Center, Seattle 	<ul style="list-style-type: none"> ▪ At the Cancer Institute, soft colors, warmer indirect lighting, wider hallways and door, and pullout sofas for visitors were introduced; on average, patients gave themselves 45% less self-administered pain medication ▪ At Methodist Hospital, patient falls dropped 60% in the cardiac wing when rooms were redesigned so the patient did not have to move from critical-care units to recovery bays ▪ At Bronson Methodist Hospital, a new facility was built with only private rooms; more private conversations occur with patients and a sharp reduction has occurred in hospital-acquired infections; hospital saving money because patients are no longer asking to be transferred to different rooms ▪ At Swedish Medical Center, small, still-life paintings were placed over cubbyholes that contained oxygen masks, suction lines, and blood-pressure cuffs; less intimidating for patients that do not like hospital equipment 	<ul style="list-style-type: none"> ▪ Hospital design can have beneficial effects for patients ▪ Room occupancy was mentioned only for Bronson Methodist Hospital, where all the patient rooms are single-occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Shumaker, S. A. & Reizensten, J. E. (1982)	<ul style="list-style-type: none"> ▪ To describe factors that affect inpatient stress in acute care settings 	<ul style="list-style-type: none"> ▪ Hospitals in general 	<ul style="list-style-type: none"> ▪ Factors that affect inpatient stress are wayfinding, physical comfort, control over privacy and personal territory, and the symbolic meaning of the environment ▪ Adjusting to the hospital is made difficult by the vulnerability of patients ▪ Aspects of environment that can affect patient comfort are noise, temperature and humidity, lighting, body position, and odors ▪ Patients are highly sensitive to hospital sounds due to pain, illness, and because they have no control over the sounds; sound-attenuating surfaces need to be provided ▪ When temperatures are incongruent with the needs of patients, stress may result; individual temperature controls should be provided ▪ Poor lighting can cause discomfort and unpleasant odors can be disturbing; glare should be eliminating and appropriate lighting should be provided for various tasks; surfaces that do not retain odors should be selected ▪ Privacy is needed by patients; they need an opportunity to rest and need space to discuss their needs and feelings with friends and families ▪ Number of patients in a room affects privacy as does the presence of an interior window to the corridor and the presence of visual screening devices 	<ul style="list-style-type: none"> ▪ An environment that meets the patient needs and gives them a sense of control helps reduce stress ▪ No specific mention is made in regards to room occupancy, though it is noted that privacy and territoriality are issues in rooms with multiple occupancy

			<ul style="list-style-type: none"> ▪ Patient control of privacy should be key to design ▪ Giving patients the ability to personalize their rooms enables them to establish their own territory and increases their sense of security and self-identity ▪ Design of patient room can convey symbolic meaning; in rooms with more than 1 patient, layout represents importance of patient privacy and territoriality 	
Solomon, N. (2003)	<ul style="list-style-type: none"> ▪ To discuss a method for treating elderly patients with delirium 	<ul style="list-style-type: none"> ▪ Saint Louis University Hospital 	<ul style="list-style-type: none"> ▪ Typically, elderly patients suffering from delirium are isolated from others and cared for in private and semi-private rooms ▪ At St. Louis University Hospitals, elderly patients suffering from delirium are treated in the Delirium room; this consists of a four-bed intensive care unit; no walls are in the room, so nurses can easily monitor patients ▪ Because of constant supervision, the fall rate of patients is near zero, and none of the patients died during an 18-month period of study ▪ Nurses try to reorient the patient and figure out why the patient is agitated; physical restraints are not used and medications are avoided 	<ul style="list-style-type: none"> ▪ A Delirium room with four beds has been found beneficial for elderly patients who become delirious

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Tate, J. (1980)	<ul style="list-style-type: none"> ▪ To describe the needs of the elderly living in institutions 	<ul style="list-style-type: none"> ▪ Institutions for the elderly 	<ul style="list-style-type: none"> ▪ Physical environment important in institution; factors that need to be considered are privacy, personal space and territoriality, and crowding ▪ Most important qualities of physical environment are amount and arrangement of space ▪ If needs for privacy and territoriality not met, negative consequences such as sense of loss of personal control and weakened personal identity may occur ▪ Private rooms should be provided, or partitions should be used in double-occupancy rooms to give person own space 	<ul style="list-style-type: none"> ▪ Private rooms, or at least one's own personal space, should be provided for the elderly to prevent negative reactions

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Ulrich, R. S. (2003)	<ul style="list-style-type: none"> ▪ To describe evidence-based design in regards to environmental features of hospitals and how they relate to patient outcomes 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Features of the environment that affect patient outcomes are noise, single vs. multiple occupancy rooms, positive distractions, quality of patient window view, and air quality ▪ Design, based on evidence, used to increase patient safety ▪ Nosocomial infections are lower in single-occupancy rooms ▪ Excess noise can worsen a patient's outcome; single rooms are quieter than double rooms ▪ Patients can experience stress if they are not in control with respect to their surroundings; privacy can increase a patient's sense of control ▪ Social support can help reduce stress and improve outcomes; roommates are a source of stress for patients and can lead to costly transfers and increased medication errors 	<ul style="list-style-type: none"> ▪ To increase the safety of patients, hospitals should provide single-occupancy rooms with good air quality

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Ulrich, R. S. (1999)	<ul style="list-style-type: none"> ▪ To describe the effects that gardens have on hospital patients 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Poor design is linked to negative effects such as higher anxiety, increased pain medication, elevated blood pressure, and sleeplessness ▪ Patients feel a sense of loss of control when they experience a loss in privacy, lack of information, inability to adjust room temperature and lighting, and way-finding difficulties ▪ Healing gardens promote a sense of control and privacy, social support, physical movement and exercise, and access to nature ▪ Gardens can facilitate social contact ▪ Patients prefer access to nature including gardens, sitting areas, views from their rooms, and pictures of nature ▪ Visual settings with nature aid in reducing stress; views of nature can reduce emotional, physiological, and behavioral components of stress ▪ Negative distractions in gardens include noise and smoking 	<ul style="list-style-type: none"> ▪ A healthcare setting with a healing garden can help reduce the amount of stress experienced by patients ▪ No mention was made in regards to room occupancy
Ulrich, R. (1992, September/October)	<ul style="list-style-type: none"> ▪ To describe design strategies that impact the well-being of patients 	<ul style="list-style-type: none"> ▪ U. S. Hospitals 	<ul style="list-style-type: none"> ▪ Good design can reduce stress and anxiety, lower blood pressure, improve postoperative courses, reduce the need for pain medication, and shorten hospital stays ▪ Facilities that are noisy, invade privacy, or interfere with social support can increase stress of patients; design should foster sense of control, access to social support, and access to positive distractions 	<ul style="list-style-type: none"> ▪ Well-designed hospital can have positive effects on patient ▪ No mention made in regards to room occupancy

Study	Focus of Article	Type of Healthcare Facility	Recommendations for Healthcare Settings	Relationship of findings to room occupancy
Williams, M. A. (1995)	<ul style="list-style-type: none"> ▪ To describe how hospital design can facilitate therapeutic goals 	<ul style="list-style-type: none"> ▪ Hospitals in general 	<ul style="list-style-type: none"> ▪ Good design should support activities essential to achieving desired patient outcomes without imposing stress on the patient; serves a symbolic function ▪ Physical design and social environment are oriented toward enhancing therapeutic goals ▪ Design supporting therapeutic goals should be flexible and must take into account the functional requisites of patients 	<ul style="list-style-type: none"> ▪ No mention made in regards to room occupancy

Empirical Articles: First and Operating Costs of Hospitals

Ashby, J. L Jr. & Lisk, C. K. (1992, Summer). Why do hospital costs continue to increase? *Health Affairs*, 11(2), 134-147.

Focus of Study	To determine how three factors, namely general inflation, medical inflation, and intensity, together determine hospital cost per case.
Research Design	Data was analyzed using a conceptual model which breaks down change in hospital operating costs per adjusted admission into seven components. Total cost per admission was established as the product of four ratios: services per admission, full-time-equivalent (FTE) employees per service, salary cost per FTE employee, and total cost relative to salary cost. These four ratios were further refined by taking into consideration employee skill-mix and productivity change, holding the skill-mix constant. Intensity of services accounted for the portion required because of increases in the complexity of patients treated and the portion expanded for patients who do not have more complex conditions. The final model is represented as the sum of changes in general economy input prices, hospital-specific input prices, patient complexity, intensity of services, employee skill-mix, non-labor factors, and service-level labor productivity.
Sample Information & Site	Data on FTE employees, admissions (adjusted for outpatient activity), total charges, and total operating expenses, were obtained from the AHA annual hospital survey. Prospective Payment Assessment Commission (ProPAC) methodology was used to estimate patient complexity change.
Findings	Inflation in the general economy accounts for the largest single contribution to the increase in hospital operating costs, which was about 40% of the average total cost increase. Inflation of prices specific to the hospital industry accounted for approximately 17% of annual increases in hospital expenses. Two thirds of this increase arose from rising wages. Non-labor input prices increased faster than prices in the general economy, especially in pharmaceuticals and malpractice insurance premiums. Patient complexity changes account for 21% of the annual increase in costs per adjusted admission and the intensity of patient care services accounted for 20% of the total annual cost increase when case

complexity was held constant. Changes in the quality and quantity of labor and non-labor inputs were related to a 2% increase in total annual costs.

Although the total increase in costs per adjusted admission was 8.7% between 1985-1987 and 9.1% between 1987-1989, the portion of the increase subject to hospital control was reduced. Expenditures on supply upgrades also decreased during the period of analysis.

The findings of this study are limited as one cannot fully account for the effect of quality enhancements on measures of productivity and intensity of services. The FTE data is limited in that it does not denote the use of contract labor nor does it account for the removal of physicians who are no longer salaried during the period of analysis. A representation of the labor hours used throughout the year may not be accurate as only the number of FTE workers employed on the last day of the year is reported. The estimates of case complexity are problematic in that medical records documentation has improved over time in its comprehensiveness.

Implications of Findings

Containment of costs should focus on controlling increases in intensity of services as well as implementing lower wage and salary increases and controlling costs spent on pharmaceuticals. No mention was made in regards to room occupancy.

Berry, R. E. Jr. (1974, Summer). Cost and efficiency in the production of hospital services. *Milbank Memorial Fund Quarterly - Health & Society*, 52(3), 291-313.

Focus of Study	To identify and measure the effects of factors that significantly impact the cost and efficiency of short-term general hospitals in the U.S.
Research Design	The data was analyzed using a model which measured hospital cost as a function of the level of output, the quality of services provided, the scope of services provided, factor prices, and relative efficiency.
Sample Information & Site	The sample included 6000 short-term general hospitals in the United States. The data was collected for the years 1965, 1966, and 1967.
Findings	<p>Hospital services are initially produced subject to decreasing costs and then eventually increasing costs. The average cost curves of hospital services were shallow “U” shapes. Empty beds lead to higher average costs for voluntary hospitals and all hospitals (the majority of the sample consisted of voluntary hospitals). Empty beds do lead to lower average costs for proprietary and government hospitals. Also, higher quality services cost more to produce than lower quality services. Average costs were found to be higher in hospitals that involve medical education and more complex inpatient services and the provision of community medical services also increase average costs.</p> <p>Length of stay has an impact on average costs as well, and for any given type of care, the early days of hospitalization are generally more expensive.</p> <p>Wage rate was the most significant variable in explaining average costs but construction costs were not significant. It appears that the capacity to provide services explains hospital costs better than the actual services provided. In addition, low-cost hospitals were more likely to have administrators with medical qualifications. Regional differences also impact average costs; New England and Pacific states tend to be higher-cost while the southern states were low-cost. Furthermore, the ratio of personnel expense to total expense is higher in low-cost hospitals than high-cost hospitals. Finally, hospitals with relatively high occupancy rates had lower costs; bed size was not significant.</p>

Implications of Findings

Several factors, such as quality of care, length of stay, wage rates, and regional differences impact the average costs of hospitals. No mention was made in regards to room occupancy.

Cho, S. H., Ketefian, S., Barkauskas, V. H., & Smith, D. G. (2003, March-April). The effects of nurse staffing on adverse events, morbidity, mortality, and medical costs. *Nursing Research*, 52(2), 71-79.

Focus of Study	To examine how nurse staffing affects adverse events, morbidity, mortality, and medical costs.
Research Design	The data was retrieved from two existing databases: Hospital Financial Data produced by California's Office of Statewide Health Planning and Development (OSHPD), and the State Inpatient Databases (SID) California-1997 released by the Agency for Healthcare Research and Quality (AHRQ). To estimate nursing hours provided and patient days in 1997, data from three fiscal years was retrieved (1996-1997, 1997-1998, and 1998-1999). Measures used included hospital characteristics, nurse staffing, patient characteristics, adverse events, morbidity and mortality, and costs. Multilevel analyses were used to examine the data.
Sample Information & Site	The sample included 232 acute care hospitals in California, excluding government hospitals and long-term care hospitals as well as non-comparable hospitals. A total of 124,204 patients from twenty surgical diagnosis-related groups were included.
Findings	<p>On average, nurses spent 8.9 hours per patient day with patients, and RN nurses provided 6.3 hours of care to patients per patient day. For the majority of patients (93.2%), no adverse events occurred during their stay. Of the adverse events that did occur, pneumonia occurred the most while falls/injuries occurred the least.</p> <p>Patient characteristics, such as age, sex, and insurance provider, were significantly associated with the occurrence of adverse events. Three types of nosocomial infections (Urinary tract infection, wound infections, and sepsis) occurred most frequently in large hospitals.</p> <p>The length of stay of patients significantly increased with the occurrence of adverse events. Patient characteristics were associated with longer lengths of stay whereas hospital characteristics were not associated. Furthermore, patient characteristics, except race and sex, were associated with mortality. The occurrence of adverse events was associated with higher costs.</p> <p>Limitations of this study include measurement issues regarding nurse staffing, a lack of consideration for hospital</p>

organizational characteristics, and the use of a non-exhaustive list of all the possible adverse events that could occur during a hospital stay.

Implications of Findings

Nurse staffing levels impact the occurrence of adverse events in hospitals. If the appropriate levels were used, operational costs could be reduced through the prevention of adverse events. No mention was made in regards to room occupancy.

Delon, G. L. & Smalley, H. E. (1970, April 1). Quantitative methods for evaluating hospital design. pp. 17-47.

Focus of Study	To develop methodology for evaluating nursing unit design.
Research Design	Qualitative checklists were developed for nursing unit designs. A model was developed from the checklists and it was applied to existing nursing units to determine its usefulness. Both uncontrollable and controllable costs were considered, including traffic and construction costs.
Sample Information & Site	The sample and site of this study were not specified though the implication is that the data applies to hospitals in the United States.
Findings	<p>Seven areas within the nursing unit serve as the basis for the beginning and end for the majority of trips made by nurses. These include the nursing station, patient rooms, supply rooms, the laundry, the kitchen, the bedpan room, and the elevators. In addition, ten areas comprise of more than eighty percent of trips originating or destined for the nursing unit. These consist of the dietary department, the surgical suite, the central supply room, the radiology department, housekeeping, the laboratory, the laundry, the pharmacy, the emergency department, and other nursing units.</p> <p>The checklists account for the relationship between nursing traffic and patient self-sufficiency, take into consideration traffic savings of multiple-occupancy rooms, and they incorporate the influence that the location of patient rooms has on traffic patterns.</p> <p>Arguments have been made suggesting the most efficient unit size is between 25 and 35 beds. Furthermore, rooms should not be further than 90 feet from the nursing station.</p> <p>Advocates of larger units argue that larger units are more efficient because better staffing patterns are achieved, the need for tall buildings is eliminated resulting in savings in elevators and plumbing, for example. Larger units also require fewer medicine units, linen rooms, and nursing stations storing materials. Advocates of smaller units argue that they are better for supervising patients.</p> <p>Hill-Burton recommends that the average size of single-occupancy patient rooms is 100 square feet, while the average size of double-occupancy and 4-bed rooms is 80 square feet. A trend exists towards the recommendation of single-occupancy rooms in hospitals. They are advantageous</p>

because higher occupancy rates can be achieved, patient care is improved, the risk of cross-infection is reduced, and greater flexibility of operation is available.

When designing single-occupancy rooms, they should be large enough to accommodate two beds. Double-occupancy rooms should be designed to be easily converted to single-occupancy rooms. Four-bed rooms should also be easily converted to two double-occupancy rooms through the addition of a bathroom.

Nursing stations require space for a head nurse office, a charting area, a medication unit, and workspace for a ward clerk.

Implications of Findings

Although arguments are made in favor of both larger and smaller nursing units as well as single- and multiple-occupancy rooms, neither design is clearly favored.

Dexter, F. & Macario, A. (2001). Optimal number of beds and occupancy to minimize staffing costs in an obstetrical unit? *Canadian Journal of Anaesthesia*, 48(3), 295-301.

Focus of Study	To describe how analyzing patient arrival and discharge data from an obstetrical unit can help to determine the optimal number of staffed beds needed in the unit. This will help maintain a balance between having as few staffed as possible, while at the same time, giving the patient the care needed.
Research Design	Data was obtained from patients admitted and discharged from the obstetrical unit at Stanford University Medical Center between October 1, 1999 and November 30, 1999. Two-hour intervals were used in measuring the number of patients present in the obstetrical unit. The researchers used the Poisson probabilistic analyses since this type of analysis takes into consideration the risk that all staff are working and are not able to take care of any additional patients that may require care. The level of risk used in this study is five percent.
Sample Information & Site	The study used data from patients admitted and discharged from the obstetrical unit at Stanford University Medical Center. The sample included 777 patients.
Findings	<p>The Poisson distributions fit the data for various times of the day. In particular, this distribution was applicable for weekdays and weekends between 6 a.m. and 6 p.m. as well as between 6 p.m. and 6 a.m. This is based on tests and the observed versus predicted differences in percentages of periods with specified numbers of occupied beds. The number of staffed beds needed on weekdays between 6 a.m. and 6 p.m. is fifteen. Twelve staffed beds are needed on weekdays between 6 p.m. and 6 a.m. as well as on weekends between 6 a.m. and 6 p.m. Only ten staffed beds were needed on weekends between 6 p.m. and 6 a.m. These numbers maintain a five percent risk.</p> <p>This type of analysis would not be useful when patients delay their admissions. It is also not adequate when gynecology patients are kept in the obstetrical unit and are then transferred when an OB patient requires admission. Similarly, the Poisson distribution assumes that the amount of patients scheduled is small. If the amount of scheduled admissions is large, the hospital can develop scheduling rules that can</p>

decrease staffing costs. Finally, this type of statistical analysis is not accurate for hospitals that have fluctuating average census levels.

Implications of Findings

For the majority of hospitals, the Poisson statistical analyses can help to determine the optimal amount of staffed beds need in an obstetrical unit. Using this method can help hospitals save money by using only the amount of staff necessary at a given time. No mention was made in regards to room occupancy in the hospitals.

Eastaugh, S. R. (2002, Fall). Hospital nurse productivity. *Journal of Health Care Finance*, 29(1), 14-22.

Focus of Study	To determine factors that impact nurse productivity using production function analyses.
Research Design	Data was collected using Atlas MediQual, the largest proprietary vendor of nurse workload and nurse scheduling systems. In this system, nursing output is specified by a point-scoring system. Production function analyses were used to determine nurse productivity. Five basic inputs were studied: nurse extenders (NEs); registered nurses (RNs); house-staff residents and interns performing some nursing activities; clerks, licensed practical nurses (LPNs) and nurse aids; and capital.
Sample Information & Site	The sample included data from 37 hospitals in the United States during the years 1997-2000. House-staff resident and intern input was not measured annually. Instead, it was measured once in 1997.
Findings	The results indicate that as RN labor becomes more costly, NE labor is used less extensively in place of RNs. This finding suggests that NEs and RNs may be a complementary team. As house-staff labor becomes more costly, however, the labor of NEs is used more extensively. A shortage of nurses did not decrease nursing productivity. Of the nursing departments in the study, the average technical efficiency realized is 81% in the year 2000. Hospitals with the worst nurse productivity did not employ NE technicians and operated at 100% RN primary care nursing. Hospitals with the highest levels of productivity heavily used NEs.
Implications of Findings	Primary care nursing is most productive when a combination of RNs and NEs is used. NEs tend to increase productivity and reduce wasted labor. No mention was made in regards to room occupancy.

Garattini, L., Giuliani, G., & Pagano, E. (1999). A model for calculating costs of hospital wards: An Italian experience. *Journal of Management in Medicine*, 71-82.

Focus of Study	To present a cost analysis method, which would enable an understanding of the distribution of resources among departments.
Research Design	Costs were assessed using a step-down allocation. Department costs, wards, and costs per stay for each ward were identified. Direct costs, overhead costs and indirect costs were identified and allocated.
Sample Information & Site	Data used for this study was based on data recorded in 1996 in terms of days of patient stay on 11 wards in Bolognini Hospital, Seriate, Italy. A total of 87,476 days of stay were recorded.
Findings	<p>Thirty cost and revenue centers were identified. Twelve were indirect departments, twelve were wards, five were overhead services, and one was for outpatient activity.</p> <p>The most expensive wards were the Intensive Cardio-Coronary Unit and ophthalmology. The average bed day costs is dependent upon the occupancy rate in which the fixed costs per unit are inversely related to the number of beds used. Cardiology and pediatrics have the highest variance in terms of bed day costs.</p> <p>There are several limitations to this study. For instance, cost allocations may have been related to the specific diseases. Also, information was extracted from manual records. Finally, overhead and indirect costs were not allocated based on real consumption due to lack of data.</p>
Implications of Findings	No mention was made in regards to room occupancy.

Li, T. & Rosenman, R. (2001, June). Cost inefficiency in Washington hospitals: A stochastic frontier approach using panel data. *Health Care Management Science*, 4(2),73-81.

Focus of Study	To use the stochastic frontier panel data model to analyze cost efficiency for hospitals in Washington State. The stochastic frontier approach uses an error-component model to encompass the firm-specific inefficiency as well as the statistical noise, which is inefficiency beyond the control of the firm.
Research Design	The data were obtained from the year-end report of financial data and activities of hospitals from the State Department of Health from 1988-1993. Of 91 eligible hospitals, data was missing for one hospital. Thus, included in the analysis were 84 not-for-profit hospitals and 6 for-profit hospitals. The data were analyzed using the stochastic frontier panel data model. The outputs included were the total number of patient days and the total number of outpatient visits. The three input prices used were labor, capital, and an aggregate of other costs.
Sample Information & Site	The study used data from 84 not-for-profit hospitals and 6 for-profit hospitals in Washington State. Specialty hospitals were excluded from the analysis.
Findings	<p>Not-for-profit hospitals are larger in terms of outputs and the number of beds. For-profit hospitals have a greater share of inpatient business and paid less for most types of labor, except those used in outpatient services, and psych inpatient and administration. Capital and other costs were lower for not-for-profit hospitals. The share of outpatient business increased for both hospitals, but the increase was greater at not-for-profit hospitals. Also, costs and labor prices increased for both hospitals, but the increase was twice as much for not-for-profit hospitals. Finally, the percent of outpatient visits made by Medicare patients decreased while their number of patient days increased.</p> <p>Hospitals with higher casemix indices or larger numbers of beds are less efficient. The severity of illness of patients (i.e. casemix index) is a significant source of inefficiency. Those with more beds are usually larger hospitals and these have more capital endowments, making them less efficient. Hospitals with higher Medicare patient days are more</p>

efficient as are for-profit hospitals. The average hospital in the sample is approximately 67% efficient.

The findings of this study are limited by the scope of the data set and the dependency of the results on a sensitive functional form chosen. Also, quality was not controlled for. Finally, the time period analyzed was one in which change occurred in the hospital industry and healthcare in general, and thus, it is difficult to apply the results out-of-sample.

Implications of Findings

Larger hospitals and those with greater casemix indices are less efficient. Not-for-profit hospitals and those with higher Medicare patient days are more efficient. No mention was made in regards to room occupancy.

Morey, R. C., Fine, D. J., Loree, S. W., Retzlaff-Roberts, D. L., & Tsubakitani, S. (1992, August). The trade-off between hospital cost and quality of care. An exploratory empirical analysis. *Medical Care*, 30(8), 677-698.

Focus of Study	To estimate the impact on hospital-wide costs if levels of quality of care are varied.
Research Design	Quality of care was measured as a ratio of actual to risk-adjusted predicted inpatient mortalities in the hospital for a given year. Nine aggregated, hospital-specific measurements of service output were used, as were nine descriptors of the hospital environment and resource expenditures. Hospitals were compared on the bases of size, volume, complexity of caseload, level of direct medical education expenditures, and level of quality of care specified. Cost estimates were based on the costs actually expended by hospitals. Information, including the number of staffed beds, outpatient activity, and expenses on medical education, was extracted from the American Hospital Association (AHA).
Sample Information & Site	The data was drawn from a 300-hospital data set obtained from CPHA. It included non-federal, short-term hospitals.
Findings	It was discovered that a hospital's total cost is highly correlated with its number of beds and its number of case-severity-weighted discharges. Non-teaching hospitals were relatively efficient and generally delivered a lower quality of care level. Larger hospitals had larger estimated marginal costs and larger average costs per death deferred. Overall, the additional, average, efficiently delivered cost for deferring one death is approximately \$29,000. The results are limited by the measure used for quality of care and the self-reported data from the AHA. Also, costs after discharge were not considered.
Implications of Findings	No mention was made in regards to room occupancy.

Thompson, J. D. & Goldin, G. (1975). The Yale traffic index. In J. D. Thompson & G. Goldin (Eds.), *The hospital: A social and architectural history* (pp. 282-295). London: Yale University Press.

Focus of Study	To determine the functional efficiency of various nursing unit designs.
Research Design	The unit of measurement used by this study was the number of trips taken by nurses. Traffic patterns were measured in four nursing units, two surgical units, and two medical units, each with V-shaped corridors. Of these units, one of each contained thirty beds and the other contained forty-eight beds. The information was recorded by observers who were positioned at the nursing stations. The information included who made the trip, where the person left from and where the person was going, and when that person went. Data was collected during 15 shifts over a six-month period.
Sample Information & Site	The study was conducted at Yale-New Haven Hospital. The sample included nurses in the various units of interest.
Findings	<p>Based on the analyses, it was determined traffic between patient rooms was affected by the geometry of the V-shaped corridor. When central facilities such as the nurses' station and utility room were located at the apex of the V, patient rooms were divided into two groups. Nurses had patients along one wing and rarely had to travel to the other wing. Researchers formed the Yale Traffic Index based on two critical variables: the distance between areas and the number of times this distance is crossed. It was determined that circulation schemes, such as the double-corridor, circular, and square plans, are most efficient, especially if the unit consisted of more than thirty beds.</p> <p>The design of the unit was found to be the most critical factor in determining the efficiency of the unit. The size of the unit and the degree of privacy offered do not influence the efficiency of the unit.</p>
Implications of Findings	Unit efficiency is determined by the design of the unit. The size of the unit, including room occupancy, is not related to the efficiency of the unit.

Thompson, J. D. & Goldin, G. (1975). The economics of privacy. In J. D. Thompson & G. Goldin (Eds.), *The hospital: A social and architectural history* (pp. 305-310). London: Yale University Press.

Focus of Study	To determine if occupancy rates are increased with all single-occupancy rooms as well as to investigate if these increased occupancy rates offset the increased costs associated with single-occupancy rooms.
Research Design	Patient rooms were simulated using a computer program. Groups of patients were generated based on characteristics such as the sex of the patients, their desire for a particular type of room, or their need for a single-occupancy room. Patients were randomly admitted to the hospital, and if possible, they were admitted into a room. The patients' length of stay was used to determine occupancy rates. Patient loads were varied and included 25,869 patients, 29,465 patients, and 33,172 patients. Various configurations of occupancy rates and room types were used. Data included the number of patients admitted and the number of patients who could be given a room, the number of service failures, the average occupancy rates per year over five-years, and the number of times patients were moved to accommodate patients wishing to be admitted.
Sample Information & Site	This study used computer-simulated data.
Findings	Only a minimal difference exists in occupancy rates when different room configurations are used. For instance, the difference between occupancy rates is only 0.37-0.39 percent during a five-year period between hospitals with only 4.6 percent single rooms and those with 100 percent single rooms. Using the United States Public Health Service standard, it was determined that only 45 patient days would be gained by using all single-occupancy rooms in the hospital. The ideal occupancy rate was considered to be 80 percent due to the smaller occurrence of service failures at this occupancy rate. Most patients requesting admission were also accommodated when occupancy rates were at this level.
Implications of Findings	The optimal mix of single- and multiple-occupancy rooms depends on medical, social, and economical factors. It is

recommended that hospitals include a minimum of 25 percent or rooms that are single-occupancy.

Thompson, J. D. & Goldin, G. (1975). *Maternity: Analysis of a random service*. In J. D. Thompson & G. Goldin (Eds.), *The hospital: A social and architectural history* (pp. 296-304). London: Yale University Press.

Focus of Study	To demonstrate that the size of the obstetrical unit affects average occupancy rates of the unit, as well as to illustrate the effect that unit size has on the investment and direct operational costs of the hospital.
Research Design	Data was obtained from 33 Connecticut hospitals in regards to occupancy rates of the obstetrical units. Unit size was measured in terms of the number of discharged patients on the unit. The hospitals were divided into three groups based on their obstetrical rates: the first group consisted of hospitals with 2,000 discharges per year, the second group contained hospitals with 1,000-2,000 discharges per year, and the third group consisted of hospitals with fewer than 1,000 discharges per year. Analyses were conducted to determine the impact of unit size on costs.
Sample Information & Site	The study utilized data from the obstetrical units of 33 hospitals in Connecticut.
Findings	Bed investment costs are higher for lower admission rates. These costs level off at 4,000 admissions per year. Direct costs per day are higher for obstetrical units servicing a small population. Hospitals with fewer than 1,000 discharges per year cost approximately 70% higher per patient day than hospitals with more than 2,000 discharges per year. Hospitals whose occupancy rates in the obstetrical units are low can create “swing” units to help service non-obstetrical patients. These units would require separate staff members for the patients and would require a separation of ancillary areas to help preserve the integrity of the obstetrical unit. The swing unit can be made larger or smaller based on the demand for obstetrical beds.
Implications of Findings	Costs are higher for obstetrical units serving a smaller population. No mention was made in regards to room occupancy.

Yafchak, R. (2000, Fall). A longitudinal study of economies of scale in the hospital industry. *Journal of Health Care Finance*, 27(1), 67-89.

Focus of Study	To determine if the long-run average costs per bed are lower in larger hospitals than in smaller hospitals.
Research Design	Data used in this study was extracted from the Medicare Cost Report for the years 1989-1997. Cross-sectional regressions were utilized to determine if the underlying cost structure of hospitals has changed over time. The unit of interest for the analyses was the number of operating beds in the hospital. A Cobb-Douglas production function was modified and used to incorporate case mix into the analyses.
Sample Information & Site	The sample included both teaching and non-teaching hospitals as well as for-profit and non-profit hospitals in the United States. Psychiatric and rehabilitation hospitals were excluded from the analysis, as were hospitals with fewer than thirty beds.
Findings	The average size of hospitals is relatively constant over time. The length of stay, on the other hand, has decreased by 17% as a shift towards outpatient care is being made. Most of the inpatient care is more complex as indicated by the case mix index. Revenue in hospitals is also decreasing as the unit of service provided by hospitals is declining. High overhead costs are incurred by hospitals since occupancy levels are relatively low. Profit margins are increasing, as are revenue and expenses. The percentage of teaching and for-profit hospitals has remained steady, but the overall number of hospitals has declined by 18%. On average, teaching hospitals are larger and service sicker patients, have higher revenues and costs, have more inpatient activity, and have slightly lower return on assets and asset turnover. Larger hospitals had lower costs per bed in the later years of the analysis.
Implications of Findings	Hospital revenues are declining as a shift occurs towards inpatient care. No mention was made in regards to room occupancy.

Zwanziger, J., Anderson, G. M., Haber, S. G., Thorpe, K. E., & Newhouse, J. P. (1993, Summer). Comparison of hospital costs in California, New York, and Canada. *Health Affairs*, *12*(2), 130-139.

Focus of Study	To compare hospital spending in two U.S. states with spending in two Canadian provinces to better understand why differences in spending exist between the two countries. Reports suggest that hospital costs per person in 1987 were about one-third higher in the United States than in Canada.
Research Design	The data used was based on admission rates and average lengths-of-stay from each region. Data was derived from the British Columbia Ministry of Health for British Columbia, the Hospital Medical Records Institute (HMRI) for Ontario, the Statewide Planning and Research Cooperative System (SPARCS) in New York, and the Office of Statewide Health Planning and Development (OSHPD) in California. The years chosen for this study were 1981 and 1985 based on a variety of reimbursement regimes used these two years.
Sample Information & Site	The study used data from patients admitted and discharged in hospitals in 1981 and 1985. Hospitals from New York State, California, British Columbia, and Ontario were used. Specialty hospitals were excluded from the analysis.
Findings	Hospital costs are lower in Canada than in New York or California. Canadian hospitals, on average, provide a greater amount of low-cost sub-acute stays of care whereas hospitals in the United States provide a far higher proportion of high-cost intensive care days. For most inpatient outputs (discharges, outpatient visits, intensive care days, and acute care days), costs in California are the highest while the lowest costs are in Canada. The only exception is subacute days. Unit costs are lower in Canada due to the production of each output at a lower cost. The rate of increase in unit costs per day or per discharge is lower in Canada than in New York or California. Canadian hospitals also seem to combine lower treatment intensity with longer inpatient stays. A greater degree of similarity exists in the outpatient area since the average incremental costs were, on the whole, identical in 1985.

A limitation of this study is that focusing solely on hospital costs provides a limited analysis. Information on the number and types of patients can help in interpreting cost differences.

Implications of Findings

Hospital costs appear to be lower in Canada than in the United States, though clear conclusions cannot be made in regards to why this discrepancy exists. Possibilities include the greater costs incurred due to the multiple-payer environment in the United States as well as differences in staffing ratios or greater use of capital equipment. Further analysis need to be conducted to make more significant conclusions. No mention was made in regards to room occupancy in the hospitals.

Non Empirical Articles: First and Operating Costs of Hospitals

Anonymous. (2003). Top 100 hospitals continue to raise the bar on quality, costs. *Capitation Rates & Data*, 8(1), 10-12.

Focus of Article	To describe characteristics of the top 100 hospitals in the United States. The information is based on the <i>100 Top Hospitals: National Benchmarks for Success</i> study conducted by Solucient.
Type of Healthcare Facility	The information in this article pertains to hospitals in the United States.
Recommendations for Healthcare Setting	Hospitals in the United States that exhibit excellence in quality and operational efficiency are also the most profitable. Metrics are used on a consistent basis in the top hospitals. Teaching hospitals tend to have the most complex mix of patients, as they are able to provide innovative treatment, while small community hospitals, with the absence of tertiary care facilities, usually have the least complex mix of patients. The top hospitals had a median total profit margin of 8.81%, while peer hospitals had a margin of only 3.69%. Between 1996 and 2000, adjusted expenses increased by 4% at the top hospitals, while at peer hospitals, the increase was 13%. The admissions per bed were 51.4 in top hospitals and 44.4 for peer hospitals, due in part to shorter length of stays at the top hospitals. Salary and benefit packages increased at top hospitals (\$43,614 vs. \$41,624 at peer hospitals). Overhead expenses are also consistently higher at top hospitals. The Northeast region of the United States is leading in producing top hospitals.
Implications of Findings	The top 100 hospitals provide high quality care while managing to reduce expenses. No mention was made in relation to room occupancy.

Anonymous. (2003, February). Data trends. U.S. hospital operating efficiency may be improving. *Healthcare Financial Management*, 57(2),102.

Focus of Article	To describe how hospitals are achieving greater operating efficiency in the United States.
Type of Healthcare Facility	The article applies to hospitals in the United States.
Recommendations for Healthcare Setting	The challenges faced by hospitals in 2003 are rising costs, declining payments, and increasing patient volumes, particular among the aging population. The trend suggested by recent changes in operating margins suggests that hospitals are achieving greater efficiency. The highest operating margins belonged to hospitals with over 300 beds in 1997, but by the second quarter of 2002, hospitals with 150-299 beds had the highest operating margins. The average daily census has also increased, as have the costs per adjusted discharge.
Implications of Findings	It appears that hospitals in the United States are achieving greater operating efficiency. No mention was made in regards to room occupancy.

Anonymous. (1981, November-December). Study challenges excess bed theory as big contributor to cost rise. *Review - Federation of American Hospitals*, 14(6), 42-43.

Focus of Article	To discuss the results of a study conducted from 1977-1979 by Ernst & Whinney, a public accounting firm. The study tested the assumption that excess beds are costly to hospitals.
Type of Healthcare Facility	Eight hospitals from the Orange County region in California that participated in the study.
Recommendations for Healthcare Setting	Excess beds in hospitals are one of the least important factors contributing to rising healthcare costs as they account for only two percent of total hospital costs. The total cost per bed per patient day in Orange County is \$8.60. Hospital utilization is growing and thus, the number of excess beds is diminishing. Also, it is impossible to have 100% occupancy in hospitals due to the diversity of patients and their illnesses.
Implications of Findings	It appears that in Orange County, excess beds are not contributing a great deal to the rise in costs of healthcare. No mention was made in relation to room occupancy.

Batchelor, G. J., & Esmond, T. H. (Jr.). (1989). Maintaining high quality patient care while controlling costs. *Healthcare Financial Management*, 21-30.

Focus of Article	To demonstrate that high quality care costs less than poor quality care. High quality care includes the elimination of unnecessary or inappropriate services while providing better clinical outcomes, fewer avoidable complications, and higher patient satisfaction. Poor quality care is related to patient dissatisfaction and negative outcomes.
Type of Healthcare Facility	The article review is intended for all hospitals in the United States.
Recommendations for Healthcare Setting	The authors suggest that the quality of patient care can be improved without increasing overall expenditures. Limiting or eliminating unnecessary or ineffective treatments associated with poor quality care can reduce hospital costs. Underutilized facilities should be closed and duplicated services should be reduced. An over utilization of tests affects hospital costs as well as quality of treatment. Customer requirements are set by the patient and are focused on the interpersonal aspect of care. Patient-centered care addresses items such as time spent by care workers talking to the patient, physical attractiveness of hospital rooms, convenient parking facilities and physical comfort.
Implications of Findings	If hospitals meet the criteria for patient-related quality care, they can save money by reducing the number of hours spent in dealing with patient complaints. This article did not deal with room density and occupancy rates.

Bennett, M. (2002, June). Finances and decision making. *Seminars for Nurse Managers*, 10(2), 80-82.

Focus of Article	To describe steps healthcare leaders can take in making non-routine decisions regarding financial impacts to the hospital.
Type of Healthcare Facility	The article applies to hospitals in the United States.
Recommendations for Healthcare Setting	The realized financial impact of non-routine decisions often varies significantly from the projected impact, and this is especially true for non-routine decisions. Healthcare leaders are often asked to make multiple non-routine decisions during the same time period, and it is difficult to determine the impact that an individual decision has on financial performance. In making these non-routine decisions, hospitals should use cost analysis. This takes into consideration all the possible alternatives and collecting and analyzing data for each alternative to determine which is best. The goal of this process is to demonstrate how financial results will differ with each alternative enabling the leaders to choose the most feasible alternative.
Implications of Findings	Healthcare leaders should use cost analysis when making non-routine decisions, as these decisions may have large financial impacts. No mention was made in regards to room occupancy.

Benton, P. (1998, January-February). Learning from others. Three key areas in hospital financing reporting. *Michigan Health & Hospitals*, 34(1), 8-10.

Focus of Article	To comment on the data collected on the financial positions of hospitals in Pennsylvania.
Type of Healthcare Facility	The information in this article pertains to hospitals in Pennsylvania.
Recommendations for Healthcare Setting	Through the process of collecting and reporting hospital financial and utilization data for eight years, three key areas of interest transpired: timeliness, comparability, and flexibility. Data reported should be the most current available as this creates an incentive for all hospitals to participate. It should also enable comparisons between hospitals with the same core business within the same geographical area. Finally, flexibility improves cooperation from the facilities and helps to produce the best report possible.
Implications of Findings	Financial reports would be improved if the data reported was current and enabled comparisons between healthcare providers. No mention was made in relation to room occupancy.

Cleverley, W.O. (2002, July). The hospital cost index: A new way to assess relative cost-efficiency. *Healthcare Financial Management*, 56(7), 36-42.

Focus of Article	To describe the Hospital Cost Index (HCI), which is an effective measure of cost-efficiency.
Type of Healthcare Facility	The article applies to hospitals in the United States.
Recommendations for Healthcare Setting	Measures of cost efficiency are often biased and do not enable comparisons between hospitals. Some factors that may affect comparisons are procedure pricing, output differences, and geographical cost-of-living differences. The Hospital Cost Index adjusts for case-mix complexity in both inpatient and outpatient operations. It weighs two measures: the Medicare cost per discharge (MCPD) adjusted for case mix and wage index and the Medicare cost per outpatient claim (MCPC) adjusted for wage index and relative-value unit. The MCPD is a measure of inpatient costs while the MCPC measures the costs of outpatient services. Data for both these measures can be obtained from Medicare cost reports. A problem with both these measures, however, is that they may not reflect the costs on non-Medicare patients.
Implications of Findings	The HCI is a reliable measure of cost-efficiency even though it assumes that the relative cost efficiency for Medicare patients will be similar to that of non-Medicare patients. No mention was made in regards to room occupancy.

Gardner, E. (1992, June 22). Eliminating inefficiencies could save hospitals \$60 billion—study. *Modern Healthcare*, 22(25), 36.

Focus of Article	To suggest that hospitals could save money by eliminating inefficiencies that prevent employees from doing their job.
Type of Healthcare Facility	The information presented in the article is intended for all hospitals in the United States. It is based on a study conducted by E. C. Murphy Ltd., a quality-consulting firm in Amherst, N. Y., in which 37, 474 employees at 59 hospitals were asked to analyze their jobs. The study also compared 1,475 hospital workers with 1,144 manufacturing workers.
Recommendations for Healthcare Setting	<p>Information from the study suggests that hospital workers waste one third of their time overcoming organizational inefficiencies. By restructuring jobs and improving communication among departments as well as streamlining their organizations, hospitals could save as much as \$60 billion each year. On average, for every \$100 spent on direct patient care, hospitals spend \$53 on clerical and communication tasks and \$25 on administration. Better-run hospitals only spend \$21 to \$42 on clerical and communication costs and \$8 to \$15 on administrative costs for every \$100 spent on direct patient care. By running hospitals more efficiently, a minimum 31% decrease in the total annual labor cost of \$210 could be achieved. Hospital employees suggest that of their wasted time, 60% came from poor communication among departments and unnecessary paperwork, 20% came from inefficient methods of operating, and the remaining was attributed to a variety of factors such as outdated equipment.</p> <p>In comparing nurses to manufacturing workers, the study estimated that the nurse's job is eight times as complex as that of a manufacturing line worker. Eliminating clerical tasks not related to patient care could increase nurse productivity and efficiency.</p>
Implications of Findings	By reorganizing and eliminating unnecessary tasks as well as improving communicating between departments, hospitals could save a great deal of money. This article did not deal with room density and occupancy rates.

Goe, S. (2002, June). Hospitals need a dual vision to provide effective care for the future. *Managed Healthcare Executive*, 12(6), 39-40.

Focus of Article	To discuss Scenario facility planning (SFP), a pre-design process which looks at thinking about future possibilities in healthcare to determine hospital needs.
Type of Healthcare Facility	The information presented in the article is intended for all hospitals in the United States.
Recommendations for Healthcare Setting	Goe suggests that when looking at the past to predict the future, bed capacity was not managed efficiently. Most hospitals are designed for inpatient care, but more than 60% of hospital revenue comes from outpatient care. Scenario facility planning suggests that hospital administrators and executives look to possible future trends in healthcare to predict future needs. One main goal of a managed care executive is to ensure that hospitals have a sufficient number of beds to operate effectively. Trends that will emerge in the future are an aging population, population growth, and cultural shifts, such as the Internet. Uncertain trends are the probability of major epidemics and the prospect of government reimbursement for healthcare.
Implications of Findings	This article suggests that hospitals should anticipate needs of the future rather than focus on trends of the past when managing hospitals. This article did not deal with room density and occupancy rates.

Hoppszallern, S. (2003). Health care benchmarking 2003. *Hospitals & Health Networks*,

Focus of Article	To describe the financial performance of hospitals.
Type of Healthcare Facility	The article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>The department performance of hospitals varies by bed size. Larger hospitals treat patients with complex illnesses that require longer stays and greater resource consumption. Total expenses per discharge are \$1187 higher in larger hospitals than smaller hospitals. Those offering the most complex and costly services are teaching hospitals and tertiary care hospitals. Inpatient nursing expenses are increasing as labor expenses have increased by 6.9% and total expenses have gone up by 8.5%. In addition, home health service levels continue to decrease. In 2001, total margins declined for all hospitals and hospitals in high-managed care markets outperformed their counterparts in profitability measures. In terms of medical practices, non-hospital multispecialty medical practices are growing faster than hospital owned practices through the addition of more physicians. Furthermore, HMO enrollment in the United States is at its lowest in five years. Finally, most opportunities for cutting costs through a reduction in length of stay have been taken.</p>
Implications of Findings	Hospitals offering more complex care incur higher total costs. No mention was made in regards to room occupancy.

Kirtane, M. (1999, April). Lessons for physicians. Why are hospitals losing money? *Tennessee Medicine*, 92(4), 123-124.

Focus of Article	To discuss the factors that led once financially successful hospitals to lose money.
Type of Healthcare Facility	The article applies to hospitals in the United States.
Recommendations for Healthcare Setting	Throughout the United States, once financially strong hospitals are downsizing to reduce expenses. In the early 1990's, healthcare institutions provided inpatient and outpatient care. They managed to reduce expenses while becoming efficient in delivering care. Hospitals and physicians then tried to neutralize the dominance of the managed care industry. An integrated delivery system (IDS) was formed and included hospitals, physicians, HMO's, home care services, and assisted living communities. Physician productivity soon decreased while expenses increased. The Balanced Budget Act of 1997, which reduced Medicare reimbursement for hospital and home care services, also created financial problems for hospitals. The majority of the hospital sponsored HMO's were financially disastrous and were terminated or sold.
Implications of Findings	Hospitals were unable to run physician practices and became financially unstable. No mention was made in terms of room occupancy.

Komiske, B. (1995). Innovations of note: Cooperative care-the ultimate in patient-centered care at a lower cost. *Journal of Healthcare Design*, 7, 181.

Focus of Article	To describe the features of the Cooperative Care Center in Providence, Rhode Island.
Type of Healthcare Facility	The material presented in this article pertains to the Cooperative Care Center in Providence, Rhode Island.
Recommendations for Healthcare Setting	<p>The mission of the Cooperative Care Center is to provide high-quality care in a hospital where healthcare professionals join the patient and their healthcare partner to treat the patient's illness. An emphasis is placed on educating the patient on how to treat and manage the illness. While the facility is a hospital, it does not include a nurse's station on the patient floors. Hospital beds are licensed, but they do not conform to the license or code of the state health department. High-quality acute care is provided at lower costs in a home-like environment.</p> <p>In order to receive care, patients must be mobile and they must have care partners with them. Care partners may leave throughout the day, but they should be with the patients at night. There is no charge for the room and board of the care partner. Privacy is important, and thus, all patient rooms are private and are locked. Patients are given beepers when they are admitted so that they may be tracked.</p> <p>The facility cost under \$128 per square foot to build. The cost per patient was \$420 per evening but has since been lowered to \$380 per evening. The cost at other Rhode Island hospitals ranges from \$440 to \$630 per evening for a private room.</p>
Implications of Findings	Patients can receive high-quality acute care at lower costs in a home-like environment, provided they have a care partner to aid in the treatment of the illness. Rooms in this facility are private.

Moore, J. (1999, December). Shared occupancy. *Contemporary Long-Term Care*, 22(12), 35-36.

Focus of Article	To discuss the advantages of shared occupancy for seniors.
Type of Healthcare Facility	The article applies to assisted living facilities in the United States.
Recommendations for Healthcare Setting	<p>Assisted living costs seniors approximately \$2500 per month, and only about 25% of seniors can afford this fee. These fees are based on private occupancy. An alternative for seniors is shared occupancy, which costs approximately \$1650 per month. The monthly service fee is about 60 to 70 percent of a private occupancy monthly fee.</p> <p>There are three unit designs for shared occupancy rooms. The first is a studio of about 350 square feet. There is also a modified one-bedroom space of about 400 to 450 square feet. Each resident has an individual sleeping area and a modest sitting area. The last alternative is a two-bedroom unit with equal sleeping areas for the residents and a larger living area; the unit is about 600 square feet. Compatibility between residents is key for shared occupancy to work.</p>
Implications of Findings	Shared occupancy is a feasible alternative for seniors that cannot afford private occupancy rooms in assisted living facilities.

Morrissey, J. (1994, September 19). Cooperative care acutely less costly. *Modern Healthcare*, 181, 32.

Focus of Article	To discuss an innovative method of acute-care at the Cooperative Care Center in Providence, Rhode Island.
Type of Healthcare Facility	The article describes the Cooperative Care Center, which is a 74-bed facility on the shared site of Rhode Island Hospital and Women & Infants Hospital.
Recommendations for Healthcare Setting	<p>Acute-care hospitals are being asked to maintain staff levels under control while providing care to more complex cases and discharging patients faster. The Cooperative Care Center has eliminated the traditional hospital structure and provides acute care at a cost thirty percent lower than traditional acute care. Family members and friends are used in the routine care of the patient and are able to take their experience home with the patient.</p> <p>Based on results at a similar facility at New York Medical Center in Manhattan, it is predicted that this type of acute care will lead to improved patient outcomes resulting in lower readmission rates as well as shorter lengths of stay, fewer medication errors, and higher satisfaction scores. Research at this center demonstrated that medication errors were 79% below the expected rate and patient falls were 41% below the expected rate for acute-care settings. This center also required 43% less personnel and cost 38% less to operate than a traditional acute-care center.</p> <p>The Cooperative Care Center was built for \$13.3 million, costing a third less than a comparable traditional acute-care center. Nursing stations were not required and patient/partner beepers replaced overhead paging systems. The cost per square foot was \$125 at this center. Rather than using standard hospital beds, which cost \$6000, hotel beds are used in patient rooms at a cost of \$300. Daily costs are at least \$140 less than those at Rhode Island Hospital where traditional care is provided, as specified on the operating license provided by the state health department.</p>
Implications of Findings	Through the use of non-traditional care utilizing family members and friends, the Cooperative Care Center has saved money and provided satisfactory care to patients. Patient

rooms are described as having beds for both the patient and care partner, and are thus designed to be private.

Priselac, T. (2000, July 17). Do-it-yourself budget relief. *Modern Healthcare*. 30(29), 26.

Focus of Article	To discuss factors that need to be take into account in funding healthcare systems. It is based on mitigating losses that are caused by the Balanced Budget Act of 1997.
Type of Healthcare Facility	The material presented in this article is intended for all hospitals in the United States.
Recommendations for Healthcare Setting	It is suggested that the foundation for a successful hospital is built on strategic, financial and operational planning based on constant observation and ongoing reassessment of internal and external factors. Several factors are mentioned that are important. Quality and service improvements are essential in attracting patients, physicians, and the best employees. Programs must constantly be developed and reviewed. Marketing is essential as is managed care, in which contracting and pricing policies are based on the needs of the present and the future. Effective management of the treasury can aid in times of uncertainty due to shifts in public policy. Fundraising is also an important tool for not-for-profit hospitals. Since hospitals are labor-intensive, effective productivity and supply chain management is the number one operational consideration. Finally, information and Internet technology help to enhance communication and data utilization in healthcare systems.
Implications of Findings	Successful operation of hospitals can occur in spite of changing governmental policies through constant evaluation of critical factors that impact hospital productivity and efficiency. This article did not deal with room density and occupancy rates.

Smet, M. (2002, September). Cost characteristics of hospitals. *Social Science & Medicine*. 55(6), 895-906.

Focus of Article	To gain insight into the literature pertaining to hospital cost structures.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>It is estimated that third party insurers pay over 85% of all hospital costs. Their reimbursement policies create cost-minimizing pressures on hospital management. Hospitals also do not achieve long-run efficient positions because they have a tendency to over-invest in capacity and equipment. Larger, more specialized hospitals may be more cost effective. Cost savings can be achieved through a decrease in the average length of stay since day costs account for about 60-70% of a 7-day stay. Having a large portion of the staff under the age of 45 also increases hospital costs, as young physicians may use more costly forms of treatment, or they are less efficient and use more hospital resources.</p> <p>Overhead costs are driven by volume of patients, capacity in terms of number of beds available, and complexity of services offered and the costs of these services. Hospital complexity increases with the growing number of discharges and the increase in number of beds.</p>
Implications of Findings	Overall, hospitals tend to over-invest in capital. No mention was made in regards to room occupancy.

Solucient. (2003). *National and local impact of long-term demographic change on inpatient acute care*. <http://www.solucient.com/publications/demochange.shtml>

Focus of Article	To discuss changing trends in healthcare demographics and its impact on the healthcare industry.
Type of Healthcare Facility	The article applies to hospitals in the United States.
Recommendations for Healthcare Setting	Over the next twenty-five years, the amount of inpatient volume in hospitals will dramatically increase. This is due to an aging baby boom generation, increasing life expectancy, rising fertility rates, and continued immigration. Of the services provided, cardiology, pulmonary medicine, orthopedics, and gastroenterology will experience the greatest growth. Bed demand will increase gradually over the next few years, at about one percent per year, but by 2012, bed demand will increase by approximately two percent annually. The South and West will experience the greatest increase in inpatient care due to continued migration. The Midwest and Northeast regions will experience modest increases in inpatient care because of the aging population. The growth of inpatient care will place a financial burden on Medicare.
Implications of Findings	Due to an aging population and other demographic trends, inpatient care will increase substantially over the next twenty-five years. No mention made in regards to room occupancy.

Terry, K. (2003, January 10). Where has all the money gone? *Medical Economics*, 80(1), 72-75.

Focus of Article	To shed light on why healthcare costs continue to increase.
Type of Healthcare Facility	The article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>In 2001, more than half the total growth in health spending came from inpatient and outpatient care as hospital outpatient spending rose 16.3%. Specialists are benefiting from this rise, while primary care physicians are not. HMO profit margins have been close to zero for the past few years. Technology is one reason the cost of care is increasing, as is the reduced authorization requirements for tests, referrals, and procedures. Furthermore, the consolidation of hospitals into bigger systems and the demand for broader networks gave hospitals more bargaining power in terms of health plans. Because of these factors, health rates rose and the use of services increased in hospitals. Insurance premiums are still on the rise because of accelerated medical-claims expenses and to make up for past losses.</p>
Implications of Findings	Hospitals and specialists are benefiting from the increase in inpatient and outpatient care while primary care physicians are not seeing any increase in wages. No mention was made in regards to room occupancy.

Thompson, J. D. & Goldin, G. (1975). Progressive patient care writ large. In J. D. Thompson & G. Goldin (Eds.), *The hospital: A social and architectural history* (pp. 317-323). London: Yale University Press.

Focus of Article	To discuss future trends in hospital planning, design, operation, and management.
Type of Healthcare Facility	The material presented in this article applies to all hospitals.
Recommendations for Healthcare Setting	<p>Hospital care should shift from thinking in terms of a progressive patient care hospital to developing a progressive patient-care centered medical system.</p> <p>Hospitalizations should be used to cure the patient as well as to educate the patient to prevent relapses from occurring. Milieu therapy can be used to combine professional support and support patient interactions. Better outcomes are achieved with this therapy through patient interactions.</p> <p>Single-occupancy rooms are not effective in this instance because patients need to be trained in groups to help one another and learn from each other.</p> <p>Two problems facing hospitals are increased costs of new programs and searching for an institution whose size meets the needs of its patients and communities. Increased hospital costs are due in part to new scientific technology. The machinery used on patients and the nursing skills required are expensive.</p> <p>Hospital costs can be decreased by reducing inpatient stays. This can be achieved through monitoring of the patients by staff members to determine whether it is necessary to keep the patient in hospital. Comprehensive care can also be promoted outside the hospital to reduce the number of hospital admissions.</p>
Implications of Findings	The role of the hospital is to meet the needs of the patients and not the interests of those providing medical care. Room occupancy was mentioned in terms of training patients, and in this instance, multiple-occupancy rooms are favored because they stimulate patient interaction, facilitating the training process.

Empirical Articles: Healthcare Facility Management and Hospital Design

Delon, G. L. & Smalley, H. E. (1970, April 1). Quantitative methods for evaluating hospital design. pp. 17-47.

Focus of Study	To develop methodology for evaluating nursing unit design.
Research Design	Qualitative checklists were developed for nursing unit designs. A model was developed from the checklists and it was applied to existing nursing units to determine its usefulness. Both uncontrollable and controllable costs were considered, including traffic and construction costs.
Sample Information & Site	The sample and site of this study were not specified though the implication is that the data applies to hospitals in the United States.
Findings	<p>Seven areas within the nursing unit serve as the basis for the beginning and end for the majority of trips made by nurses. These include the nursing station, patient rooms, supply rooms, the laundry, the kitchen, the bedpan room, and the elevators. In addition, ten areas comprise of more than eighty percent of trips originating or destined for the nursing unit. These consist of the dietary department, the surgical suite, the central supply room, the radiology department, housekeeping, the laboratory, the laundry, the pharmacy, the emergency department, and other nursing units.</p> <p>The checklists account for the relationship between nursing traffic and patient self-sufficiency, take into consideration traffic savings of multiple-occupancy rooms, and they incorporate the influence that the location of patient rooms has on traffic patterns.</p> <p>Arguments have been made suggesting the most efficient unit size is between 25 and 35 beds. Furthermore, rooms should not be further than 90 feet from the nursing station.</p> <p>Advocates of larger units argue that larger units are more efficient because better staffing patterns are achieved, the need for tall buildings is eliminated resulting in savings in elevators and plumbing, for example. Larger units also require fewer medicine units, linen rooms, and nursing stations storing materials. Advocates of smaller units argue that they are better for supervising patients.</p> <p>Hill-Burton recommends that the average size of single-occupancy patient rooms is 100 square feet, while the average size of double-occupancy and 4-bed rooms is 80 square feet.</p>

A trend exists towards the recommendation of single-occupancy rooms in hospitals. They are advantageous because higher occupancy rates can be achieved, patient care is improved, the risk of cross-infection is reduced, and greater flexibility of operation is available.

When designing single-occupancy rooms, they should be large enough to accommodate two beds. Double-occupancy rooms should be designed to be easily converted to single-occupancy rooms. Four-bed rooms should also be easily converted to two double-occupancy rooms through the addition of a bathroom.

Nursing stations require space for a head nurse office, a charting area, a medication unit, and workspace for a ward clerk.

Implications of Findings

Although arguments are made in favor of both larger and smaller nursing units as well as single- and multiple-occupancy rooms, neither design is clearly favored.

Douglas, C., Steele, A., Todd, S., & Douglas, M. (2002, October 17). Primary care trusts. A room with a view. *Source Health Service Journal*, 112(5827), 28-29.

Focus of Study	To investigate how hospital design helps patients recover.
Research Design	The study was conducted over a twelve-month period. Several inpatients were interviewed and questionnaires were sent to inpatients that had stayed five days or more on medical, surgical, or maternity wards as well as those that stayed on wards where care was provided to the elderly regarding their experiences and satisfaction with their stay. Community groups were also set up and included people from the community as well as experts from the Royal Institute of British Architects and the Royal Institute of Chartered Surveyors. The focus of these meetings was to discuss what constituted a patient-friendly environment.
Sample Information & Site	The study was conducted at Salford Royal Hospitals in England. Fifty inpatients were interviewed and questionnaires were mailed out to 2,200 people. Of these questionnaires, 785 were returned.
Findings	<p>Those attending the community group meetings suggested that hospitals include good signage, good lighting, privacy for patients, reduced noise levels, temperature controls for patients, access to nature, safety and security provisions, accommodations for visitors and good landscaping. Suggestions were also made for children's play areas, shops and personal services, and catering facilities that operated all day.</p> <p>Those interviewed wanted a welcoming environment, enough space to allow for privacy and to accommodate visitors, views of nature, and a design that would facilitate communication between staff, patients, and family members. Those who returned the questionnaires indicated that though they were generally satisfied with the care they received, they disliked the lack of privacy they had and the mixed-sex wards. Those who stayed in single occupancy rooms and in the small bays clustered around a nursing station were most satisfied with their stay. Suggestions were made to improve the atmosphere of the wards to make it more welcoming, to improve the quality of the curtains, to increase storage space, to include adjustable lighting and temperature control, to</p>

improve the views of the outside, and to increase the amount of space for visitors.

Implications of Findings

Those that stayed in private rooms and small bay wards clustered around a central nursing station were most satisfied with their stay.

Gadbois, C., Bourgeois, P., Goeh-Akue-Gad, M. M., Guillaume, J., & Urbain, M. A. (1992). Hospital design and the temporal and spatial organization of nursing activity. *Work & Stress*, 6(3), 277-291.

Focus of Study	To analyze the spatial and temporal organization of nurses' work in medical and surgical units of French hospitals.
Research Design	Nursing activity was observed and recorded on a U-shaped ward. The observer recorded activity related to the sequence of areas visited, the tasks executed in these areas, the reasons for travel between these areas, and the times of entry and exit in these areas. Data was collected during the day shift over a six-month period.
Sample Information & Site	The study took place in a medical and surgical ward in a private hospital in Paris. The sample included nurses working on this ward.
Findings	<p>It was determined that nursing work is divided into various acts, which are distributed through time and space. The majority of the activities performed by nurses lasted less than two minutes on either unit. An average of 23 activities per hour were performed in the surgical unit, while an average of 25.3 activities per hour were performed on the medical unit. The work performed by nurses resided in various sites. On the surgical unit, nurses performed 3855 trips that lasted approximately 3 minutes and 25 seconds each. 4521 trips were performed by nurses on the medical units, each lasting approximately 3 minutes and 9 seconds. A large number of activities performed in one area, such as the corridor or patients' rooms, were followed by an activity in another location. The constant movement by nurses varied based on the spatial organization of the unit as well as the temporal structure of the tasks.</p> <p>Nurses' work areas can be divided into four categories: the patients' rooms, the nurses' area, the corridor, and other specialized areas such as storage and medical offices.</p> <p>Nurses generally followed three paths in their trips: different points of the nurses area, trips between the patients' rooms and nurses' area, and trips between patients' rooms. Trips were organized according to spatial and functional logic. On the surgical unit, nurses were interrupted, on average, once every 20 minutes, while on the medical unit, nurses were interrupted an average of once every 12 minutes.</p>

Visibility of staff members was difficult due to the U-shaped design of the ward.

Implications of Findings

The work of nurses is dependent upon the spatial configuration of the ward as well as the temporal organization of the work. No mention was made in regards to room occupancy.

Kirk, S. (2002, December 10). Patient preferences for a single or shared room in a hospice. *Nursing Times*, 98(50), 39-41.

Focus of Study	To look at the preference of hospice patients for either single or shared rooms. The study also investigates factors that may alter a patient's preference.
Research Design	Researchers conducted structured interviews with twenty-four patients in two hospices (Twelve patients from each hospice were interviewed). The interviews looked at the patients' preferences and experiences in single or shared rooms.
Sample Information & Site	The study was conducted at two hospices in Leeds, England. Twelve patients in two hospices were interviewed. Six males and six females from each hospice participated. Three of the males and three females occupied single rooms, while the other patients occupied shared rooms. Nineteen of the patients had previously stayed in a single room and twenty-three patients had experience in shared rooms.
Findings	In terms of preferences for single or shared rooms, eighteen of the patients preferred a single room, five preferred a shared room, and one did not hold a strong opinion on either room. Some of the reasons given for preferring a single room are privacy, quiet, avoiding upsetting other patients, reduced embarrassment, improved quality of sleep, and having a family member stay. Reasons given for preferring a shared room included having company and being able to share one's experiences. Eighteen patients stated they would want to move from a shared room to a single room if they had diarrhea or vomiting. Only twelve patients said they would want to move if another patient was dying. A limitation of this study is its small sample size.
Implications of Findings	The majority of patients preferred single rooms to shared rooms, especially if they were suffering from distressing symptoms. Patients with previous experiences in single rooms were more likely to prefer a single room.

Pease, N. J. F. & Finlay, I. G. (2002). Do patients and their relatives prefer single cubicles or shared wards? *Palliative Medicine*, 16(5), 445-446.

Focus of Study	To determine the preferences of patients and family members in regards to single and multiple occupancy rooms on an oncology ward.
Research Design	Questionnaires were given to fifty patients who were admitted consecutively on an oncology ward. Questionnaires were also given to family members of these patients in regards to their preference for single or multiple occupancy rooms.
Sample Information & Site	<p>The sample included fifty patients on an oncology ward. Twenty-one males and twenty-nine females agreed to participate, but seventeen patients died during admission. Thirty-six family members of the patients were surveyed as well.</p> <p>The study took place on a 17-bed oncology ward in England that provides both oncology and palliative care for the severely ill patients in the cancer center. There are three single occupancy rooms on this ward, while the remaining area is open, with partitions between three four-bed areas and one two-bed area.</p>
Findings	Of the patients surveyed, only twenty percent of them preferred single occupancy rooms. Thirty-four percent preferred to be in an open area while twelve percent of patients did not have a preference. Of the relatives surveyed, twenty-eight percent preferred for their family member to be treated in a single occupancy room. The wishes of the family members and the patients agreed in only fifty percent of the cases surveyed. The main reason that patients preferred a four-bed bay was to avoid isolation. The majority of patients and all relatives stated that they would use a day room if one were available.
Implications of Findings	Ward design on an oncology ward should include some single cubicles as well as open areas, as the majority of patients prefer to stay in multiple occupancy rooms.

Reid, E. A. & Feeley, E. M. (1973, January). Roommates. *American Journal of Nursing*, 73(1), 104-107.

Focus of Study	To determine the perceptions of patients in relation to factors involved in sharing a double-occupancy room.
Research Design	Questionnaires were mailed out to patients who had stayed in a double-occupancy room in a large community hospital three days after they had been discharged. The respondents were asked about their background, their hospital stay, and their experiences with their roommates.
Sample Information & Site	The sample included 100 patients who had stayed in a double-occupancy room in a large community hospital in the United States. Of the 100 questionnaires mailed out, fifty-four were returned and fifty-one were useable.
Findings	Fewer than half the respondents would prefer to stay in a private room if given a choice. Some patients would have, however, preferred a different roommate. Patients enjoyed double-occupancy rooms because they felt they had someone to talk to and they could help each other out. Privacy was an issue for some in these rooms. Double-occupancy rooms were also problematic when noise levels were high and when one patient had too many visitors. Roommates that were very ill or that had a large age difference between them were undesirable.
Implications of Findings	Overall, patients preferred double-occupancy rooms to private rooms.

Shepley, M. M. (2002). Predesign and postoccupancy analysis of staff behavior in a neonatal intensive care unit. *Children's Health Care, 31*(3), 237-253.

Focus of Study	To provide data on the behavioral issues associated with the design of a neonatal intensive care unit.
Research Design	This study used a multimethod approach, which included behavioral mapping, interviews, questionnaires, and calibrated measures of walking, noise, and temperature. Observations were made of staff members over a 3-hour period and information was recorded in terms of patient census, staff designation, activity location, and time data. The interviews and questionnaires focused on the efficiency of the floor plan, the impact of natural light, and perceptions of space allocation.
Sample Information & Site	The sample included nursing staff that worked on the predesign and postoccupancy units. Twenty-one staff members were observed, ten staff members filled out questionnaires, and eight staff members were interviewed. The study was conducted prior to and after renovations were made to a neonatal intensive care unit. The original unit consisted of six small rooms that accommodated one to five babies in each room. The new unit was open and divided into bays of six baby stations each.
Findings	<p>The new design focused on the development of a more efficient floor plan, the provision of space for supportive family-centered care, and the use of natural light. On the new unit, nurses were found to spend most of their time in active baby care followed by walking, conversations, passive baby care, and charting. More time was spent taking care of the babies on the new unit than on the old unit.</p> <p>Those responding to the questionnaires perceived the new unit as comforting and clean but less secure than the old unit. Family-centered care was perceived as supportive of babies and their families, though its ratings were lower for the supportiveness of nurses and physicians. The unit was rated as generally being efficient and the new lighting was thought to have a positive impact on the patients.</p> <p>Those who were interviewed felt that families were utilizing the majority of space designated to them. They felt the design was efficient, lighting was improved, and noise levels were lower.</p>

Implications of Findings

For the most part, the new unit was rated positively. Nurses were able to move at a greater velocity in the new unit as well as spend more time with the infants.

Trites, D. K., Galbraith, F. D. Jr., Sturdavant, M., & Leckwart, J. F. (1970, December). Influence of nursing-unit design on the activities and subjective feelings of nursing personnel. *Environment and Behavior*, 303-334.

Focus of Study	To investigate the impact of radial, single-corridor, and double-corridor nursing unit designs on the activities and subjective feelings of nurses working on these units.
Research Design	Twelve observers collected work sampling data over a period of eighty-two days. Nurses were also asked to complete questionnaires pre-shift and post-shift, which examined patient care and the subjective feelings of staff members. The units examined were four units of each design type. These designs included radial, single-corridor, and double-corridor.
Sample Information & Site	The study took place at Rochester Methodist Hospital. The sample included 590 staff members who worked on the units.
Findings	In terms of nursing activities and their locations, radial design was found to be the best design, while single-corridor design was the worst of the three designs. Nurses had the most accidents on the single-corridor design and the lowest absenteeism on the radial design. The majority of nurses stated that they would prefer to work on the radial design unit and the radial design had the most positive effect on the subjective feelings of the nurses studied. Time spent traveling by nurses was lowest on the radial design unit.
Implications of Findings	The radial design was preferred as nurses spent less time in travel than those on the other units and, as a result, they were able to spend more time with patients.

Trites, D. K., Galbraith, F. D. Jr., Leckwart, J. F., & Sturdavant, M. Radial nursing units prove best in controlled study. *Modern Hospital*, 112(4), 94-99.

Focus of Study	To investigate the impact of radial, single-corridor, and double-corridor nursing unit designs on the activities and subjective feelings of nurses working on these units.
Research Design	Nursing students collected work-sampling data between June and September of 1967. Nurses were also asked to complete questionnaires pre-shift and post-shift, which examined patient care and the subjective feelings of staff members. The units examined were four units of each design type. These designs included radial, single-corridor, and double-corridor. The radial units contained one private room, while the linear designs had four to ten private rooms.
Sample Information & Site	The study took place at Rochester Methodist Hospital. The sample included 590 staff members who worked on the units.
Findings	The radial design was superior to the other designs on all three shifts. Nurses spent significantly less time traveling on this ward, and in turn, they were able to spend more time with patients. The average distance from the center of the radial nursing unit to the patient's bedside is 34 feet; in the double-corridor design the distance is 48 feet; on the single-corridor design the distance is 71 feet. Nurses preferred working on the radial unit and fewer staff absences and fewer accidents occurred on the radial unit. A fewer amount of complaints were received on the radial unit by patients, relatives, and physicians.
Implications of Findings	The radial design was preferred as nurses spent less time in travel than those on the other units and, as a result, they were able to spend more time with patients. No reference was made in terms of the impact room occupancy had on nursing efficiency.

Veatch, R. M. & Veatch, L. L. (1994, Winter). Hospital roommates: An interview with a terminally ill patient. *Cambridge Quarterly of Healthcare Ethics*, 71-80.

Focus of Study	To present information regarding the impact that roommates have on one another in the hospital environment.
Research Design	This study followed the experiences of one man in regards to his hospitalizations and his experiences with roommates. He was interviewed in his home.
Sample Information & Site	The case study was of a 72-year old man with metastasized cancer, a herniated diaphragm, trigeminal neuralgia, a partially paralyzed leg, and diverticulitis.
Findings	The quality of patient care is affected by the patient's interaction with roommates. One's roommate can create anxiety and confusion regarding the responsibility one has toward the roommate. Roommates can also create anxiety in a patient in terms of the experience of pain and medication. Nurses should be made responsible for assessing the impact that roommates have on each other. They should have conversations with patients and their family members in regards to any concerns they may have with roommate assignment. Care should be taken in placing patients with roommates, and sensitivity should be used with assigning roommates with the same diagnoses, especially if they are at different stages of the disease.
Implications of Findings	If patients are in multiple-occupancy rooms, care should be taken in assigning them a roommate.

Whitehead, C., Polsky, R. , Crookshank, C. & Fik, E. (1984). Objective and subjective evaluation of psychiatric ward redesign. *American Journal of Psychiatry*, 141(5), 639-644.

Focus of Study	To describe and evaluate the redesign of a psychiatric unit, which used a psychoenvironmental model.
Research Design	Various patients were observed prior to and eight weeks after moving to a redesigned ward. The original ward was in the shape of a cross and included large open dormitories at the top and on one arm of the cross. The day room was located along the other arm. The redesign housed the same number of patients, but the long corridor is broken up and flexibility was increased to the day and group room areas. To measure their behaviors, the Behavioral Environment Assessment Technique was used, as was the Sepuvelda Psychoenvironmental Assessment Record.
Sample Information & Site	The study was conducted in a 30-bed psychiatric facility. Subjects included male and female veterans whose ages ranged from early twenties through the sixties.
Findings	Prior to the redesign, socially related behaviors occurred more often in the hallways and hall intersection. After the redesign, socially related behaviors were more common in the visiting room, cafeteria, and day room. Staff were also seen more frequently in the day room after the redesign, as opposed to the nursing station prior to the changes. Staff and patients both responded positively to the changes, but patients were more affected by the change than the staff, as exhibited by their strong positive reactions to some of the changes.
Implications of Findings	The subjective experience of patients was improved as was staff behavior after the ward was redesigned. Although an emphasis was not placed on room design, it was mentioned that patients were in dormitories.

Non Empirical Articles: Healthcare Facility Management and Hospital Design

Aldridge, E., Smith, L. D., & Sperling, L. (1991). VIP suites: A new trend, *Journal of Healthcare Interior Design*, 3, 85-95.

Focus of Article	To describe the design of VIP suites in hospitals.
Type of Healthcare Facility	The facility described in this article is the Camellia Pavilion at the University of Alabama Hospital.
Recommendations for Healthcare Setting	<p>The unit consists of twenty beds, all of which are private. The rooms are a minimum of 390 to 400 square feet, and the rooms are double in size when they consist of a sitting room as well. Armoires conceal televisions and VCRs, and patients have the ability to use computers if they desire to. Bathrooms consist of a tub and shower as well as soaps, towels, refrigerators, and terry cloth robes. The décor of the unit is based on a Georgian style. The facility also includes specialty areas such as a gourmet kitchen, a fitness center, and family rooms.</p> <p>The facility is designed for non-acute patients only. The ratio of nurses to patients is one to four.</p> <p>The cost of staying in these suites is slightly greater than staying in a regular semiprivate room.</p>
Implications of Findings	The rooms in this facility are private, and the majority of them also consist of a sitting room.

Anonymous. (2001, March). 'Speedy' patient rooms to debut at Cheyenne's United Medical Center. *Facilities Design & Management*, 20(3), 10.

Focus of Article	To describe the features of a new six-story tower at United Medical Center in Cheyenne, Wyoming.
Type of Healthcare Facility	This article features the United Medical Center in Cheyenne, Wyoming. The non-profit hospital is in the midst of a two-year \$25 million construction project. A new six-story tower will include 195 beds. Private patient rooms are being constructed in addition to 115 medical/surgical rooms and five isolation rooms.
Recommendations for Healthcare Setting	The new patient rooms are comfortable and have a clean, modern look. Patients are able to control the lights and blinds from the beds. A sleeper sofa is available for family members who stay overnight. In-room nurses' stations are included in the design. These areas give the nurses and clinical staff a separate area to work so they don't have to use the patient's private bathroom.
Implications of Findings	While the use of private patient rooms is suggested, it is unclear if all the patient rooms are private. No empirical evidence is given to support the use of private rooms.

Anonymous. (2000, March). Designing a streamlined recovery. *Facilities Design & Management*, 19(3), 12.

Focus of Article	To discuss how the patient rooms of the future will be designed. The information is based on the opinion of H. Bart Franey, the CEO of Wellness, LLC in Nashville, a company that designs and installs modular hospital patient rooms.
Type of Healthcare Facility	This article pertains to the TriStar Health System's Centennial Medical Center in Nashville.
Recommendations for Healthcare Setting	Franey suggests that the patient room of the future will be larger. The larger room will help to actively promote healing and staff efficiency. It will also increase flexibility to allow healthcare professions to adapt to technological advances. The rooms should be holistic in nature and use flowing, curved surfaces, soothing colors, in-room nursing stations and easy to clean floor and wall coverings.
Implications of Findings	Larger rooms will be beneficial to both staff and patients. No mention was made in regards to a preference for single or multiple room occupancy.

Anonymous. (2000, January). Hospitals discover cost efficiency of private rooms. *Executive Solutions for Healthcare Management*, 3(1), 7-8.

Focus of Article	To describe the reasons why two healthcare facilities have chosen to change their semi-private rooms into private rooms.
Type of Healthcare Facility	The information in the article applies to two facilities. These are Northwestern Memorial Hospital in Chicago and William Beaumont Hospital in Royal Oak, Michigan.
Recommendations for Healthcare Setting	<p>Northwestern Memorial Hospital has converted all its semi-private rooms into private rooms. This is due to the belief that privacy is a critical factor for a patient's comfort. Because they believe that families are important in the care process, each room has a window seat with a pullout bed to accommodate visitors. William Beaumont Hospital is in the process of converting 70% to 80% of its beds into private rooms. Currently, 85% of Beaumont's beds are semi-private. Ninety percent of patients at Beaumont hospital request private rooms, but the hospital usually does not have any to offer. The semi-private rooms typically have a 10% lower occupancy rate than the private rooms, and combined with transfer costs, private rooms are a better alternative.</p> <p>Some of the benefits of private rooms include shortening one's length of stay and cutting costs. Private rooms also help reduce the risk of acquiring a hospital born infection as well as reduce the risk of medication errors. This information is based on a cost-benefit analysis conducted by Watkins, Hamilton, Ross Architects on the William Beaumont Hospital.</p>
Implications of Findings	Both Northwestern Memorial Hospital and William Beaumont Hospital are in favor of private rooms.

Anonymous (1998, October). Critical care update. *Facilities Design and Management*, 17(10), 48-49.

Focus of Article	To describe the remodeling of the telemetry and intensive care units at Methodist Hospital.
Type of Healthcare Facility	The information presented in this article pertains to Methodist Hospital in St. Louis Park, Minnesota.
Recommendations for Healthcare Setting	This facility was remodeled with a focus on improving working conditions on a telemetry unit. Care was decentralized and the number of private rooms was increased from twelve to sixteen. If the demand for beds exceeds the supply of beds, patients are placed in an eight-bed swing area. The central nursing station was eliminated and bathrooms were repositioned to enable the placement of charting alcoves. These alcoves are located along the corridors and are dispersed among the patient rooms. They are furnished with seating, storage, lighting, and a work surface along with a telephone and a computer. Infrared technology is used to track staff members down when they are needed.
Implications of Findings	In this facility, the number of private patient rooms were increased, and if more beds are needed, patients are placed in a multi-bed swing area.

Anonymous. (1991a). The design of buildings. *Health Services Management*, 87(1), 3-4.

Focus of Article	To discuss how hospitals should be designed in the future.
Type of Healthcare Facility	The material presented in this article applies to hospitals in England.
Recommendations for Healthcare Setting	Hospital design should enable the departments and staff to run efficiently and should meet the needs of staff as well as be pleasant for patients. The norm for independent hospitals and for private wings in the NHS is single rooms. The case against single rooms is their cost in terms of building and staff. Supervision of patients is also more difficult with single rooms. An argument is made towards open wards as supervision is best on these wards and patients are given more privacy than in the four or six bed wards.
Implications of Findings	While there is an increasing trend towards single rooms, due to their cost and the difficulty of supervising patients, open wards may be better. Supervision is increased on these wards and patients are given more privacy than in the bay wards.

Anonymous. (1991b). Patient-focused hospital. *Health Services Management*, 87(1), 4

Focus of Article	To describe aspects of a patient-centered hospital.
Type of Healthcare Facility	The material presented in this article applies to hospitals in England.
Recommendations for Healthcare Setting	<p>The goal of the patient-centered hospital is to decentralize so that services are brought nearer to the patient. Decentralization requires the appropriate equipment, appropriate staffing, and an appropriate size unit. It is suggested that then optimal number of beds in a ward should be about 130.</p> <p>Patient-focused hospitals are lest costly to build than traditional hospitals and the main costs are running costs, in particular, staffing.</p>
Implications of Findings	Patient-focused hospitals are a viable alternative to traditional hospitals. No mention was made in regards to room occupancy.

Anonymous. (1971, October). New hospital will offer private accommodations in a semi-private room. *Modern Hospital*, 117, 84-85.

Focus of Article	To describe a newly devised semi-private room that offers private space to both of the occupants.
Type of Healthcare Facility	The information in this article applies to Carlisle Hospital, PA.
Recommendations for Healthcare Setting	<p>The author suggests that the design makes it possible for one patient to converse with visitors without inconveniencing or disturbing the other patient. It is also possible for staff members to provide treatment and services to one patient without disturbing the other patient. Both patients have equal access to the toilet and wardrobe facilities and both have equal access to the outside through two windows in each room. Pillow speakers allow each patient to listen to or watch radio or television programs without creating distractions or discomfort for the other patient. A standard fabric curtain set in a recessed ceiling track is used to separate the patient areas. Windows are indented six feet from the building façade, creating an overhang that provides sun and weather protection.</p> <p>Each patient room occupies an area of 351 square feet. Normal rooms are approximately 300 square feet. The extra fifty feet adds approximately \$2000 to the cost of each room. Bright colors are used throughout the nursing units, which are designed with a conventional structural system. This eliminates costly framing. The nurses' stations are centrally located and are not more than ninety feet away from any patient room.</p> <p>The color schemes are different for each patient room on the same corridor. Rooms with the same basic color are as distant from one another as possible. All the rooms are carpeted. A day room, located adjacent to the nursing unit and elevators, offers an exterior view.</p>
Implications of Findings	Through this design, patients are able to experience the privacy of a single room in a semi-private room.

Bacon, A. S. (1920). Efficient hospitals. *Journal of American Medical Association*, 24(2), 123-126.

Focus of Article	To describe the ward design of an efficient hospital.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>The ideal efficient hospital should serve people in moderate circumstances and should provide them with all the conveniences of the most exclusive institutions. Hospitals are not achieving maximum bed capacity because of diseases that become epidemics and because of differences in preferences between males and females. Private rooms increase flexibility and help hospitals achieve maximum bed capacity. Also, patients are provided with more comfort, better examinations can take place in these rooms, temperatures can be controlled based on the needs of the patients, and visiting schedules can be adjusted based on the patient. A centralized control system is needed to prevent poor judgment by nurses as well as to provide a means of checking up more systematically.</p>
Implications of Findings	Private rooms are desired to maximize bed occupancy and to provide patients with a more comfortable environment.

Baker, J. & Lamb, C. W. Jr. (1992). Physical environment as a hospital marketing tool. *Journal of Hospital Marketing*, 6(2), 25-35.

Focus of Article	To illustrate the importance of managing the physical environment in hospitals as well as to explore the role of the physical environment in hospital marketing.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>The physical environment of the hospital plays four important roles in the marketing of health care services. These include: communication, contributions to the psychological welfare of patients, contributions to the perceptions of service quality, and market targeting and positioning.</p> <p>In terms of communication, the appearance of a patient's room conveys the attitude of hospital management towards the needs of the patients. Patients' attitudes are also affected by the design of the building, signage, lighting, and reception areas. Staff members are also affected by building design, and attention to their needs can improve morale and service to patients.</p> <p>Good building design helps to minimize patient stress and permits feelings of competence and control.</p> <p>Environments that are pleasant, comfortable, and relaxing contribute to patient satisfaction.</p> <p>Patients are increasingly given more control in choosing the healthcare facility they want to be treated in, and thus, appearance is critical in attracting patients.</p>
Implications of Findings	Patients and staff are affected by the hospital environment, and a positive environment can boost staff morale and productivity and can make the stay more pleasant for the patient. No mention was made in regards to room occupancy.

Barista, D. (2000, November). Health care embraces hospitality. *Building Design and Construction*, 41(11), 36-40.

Focus of Article	To describe changes made to Baptist Memorial Hospital to make the environment more pleasant for patients.
Type of Healthcare Facility	The design described in this article applies to Baptist Memorial Hospital in Collierville, Tennessee.
Recommendations for Healthcare Setting	The hospital design incorporates more private rooms that are large enough to accommodate family members and integrate hospital equipment. Most rooms are divided into two sections: a patient area and a family area. The design is fueled by changes in healthcare delivery as well as increased competition between facilities. The design is based on the “medical mall” concept, which integrates healthcare departments into the layout of a retail mall. It consists of a main lobby and long corridors that lead to each department and allows for smooth outpatient-traffic flow. This design also facilitates future expansion.
Implications of Findings	The design incorporates more private rooms that are large enough to accommodate family members as well as integrate necessary equipment.

Bilchik, G. S. (2002, July-August). A better place to heal. *Health Forum Journal*, 45(4), 10-15.

Focus of Article	To describe various facilities incorporating the pebble project, which uses empirical evidence to evaluate impacts of healthcare design.
Type of Healthcare Facility	The facilities featured in this article are Children's Hospital in San Diego, Methodist Hospital/Clarian Health Partners in Indianapolis, Bronson Methodist Hospital in Michigan, and the Barbara Ann Karmanos Cancer Institute in Michigan.
Recommendations for Healthcare Setting	<p>Children's Hospital in San Diego is opening a convalescent care hospital, which is designed to promote long-term care for permanently disabled children. The design includes wheelchair storage in patients' rooms that is out-of-sight, as well as private spaces outside the patient rooms for parents to hold their children. The air ventilation system will be improved and it is expected that fewer respiratory infections will occur.</p> <p>The Methodist Hospital in Indianapolis opened a 56-bed cardiovascular critical care unit. Patients are admitted directly to their rooms from the emergency room, admitting, physicians' offices or the Lifeline helicopter. Patient rooms are private and patients are in control of the temperature and light. Each room also has an interior window that can become opaque to increase privacy. Nurses can observe patients better and the number of falls has decreased by half and transfers have decreased substantially from 200 per month to an average of 20 per month.</p> <p>Bronson Methodist Hospital in Michigan opened a new facility with private patient rooms. Patients have access to nature through indoor gardens, natural light, and landscape views. Stress is reduced through the use of positive distractions such as music, water sounds, artwork, and daylight.</p> <p>The Barbara Ann Karmanos Cancer Institute renovated several hospital areas to be patient-centered and to provide a more pleasant environment. Medical rooms were made larger and an emphasis was placed on lighting and acoustics. A decrease has occurred in the use of pain medication on these units as well as a decrease in medication errors.</p>

Implications of Findings

The majority of these facilities incorporated private rooms into their designs and patients have had successful outcomes in these new and renovated facilities.

Bobrow, M. & Thomas, J. (2000). Inpatient care facilities. In Kobus, R. et al., *Building type basics for healthcare facilities* (pp. 131-192). New York: John Wiley & Sons.

Focus of Article	To describe efficient designs of patient rooms and nursing units.
Type of Healthcare Facility	The material presented in this chapter applies to all hospitals.
Recommendations for Healthcare Setting	<p>The patient rooms is seen as a place where the patient and family members can have control of their lives and their environment. It is also looked upon as a place of privacy, safety, and sanctuary. The nursing unit is an extension of this environment, and provides a family support system. The primary goal of nursing design is to minimize the distance traveled by nurses as well as the range of distance between patient rooms and the nurse work core.</p> <p>Efficient nursing plans include groupings of concentric pods and the use of bedside computers. Examples of previously used nursing unit designs include the double corridor plan, the compact rectangular plan, and the compact circular plan. Patient rooms have evolved from open wards to single- and double-occupancy rooms. Single-occupancy rooms are favored because patients are given privacy in these rooms and these rooms can be used for isolation purposes. Medication errors are also reduced with a reduction in patient transfers. This also reduces hospital costs, as transfers in multiple-occupancy rooms can average from six to nine per day. Occupancy rates also increase with single-occupancy rooms. In multiple-occupancy rooms, occupancy reaches an average of 80 to 85 percent, whereas in single-occupancy rooms, occupancy can reach 100 percent. Single-occupancy rooms should be flexible to accommodate patients requiring general acute care as well as those requiring isolation. Patients prefer single-occupancy rooms because they are given greater privacy, space is provided for family members, and patients are able to control their environment, such as lighting and temperature. Universal rooms are large enough to accommodate various bedside treatments and are situated to allow for maximum patient visibility by nurses.</p> <p>The San Bernardino County Arrowhead Regional Medical Center in California was designed to include a cluster of units connected by beds on the perimeter. Three 24-bed nursing units are located on one floor and each nursing unit has three</p>

substations, each assigned to eight beds. Single-occupancy rooms are used in this design.

The environment provided should be sensitive to the needs of patients including comfort and control. Natural light should be incorporated whenever possible.

Maximum flexibility and use of patient beds can be achieved by creating generic patient units, providing patient beds that can be used for a variety of acuity levels, and providing a sufficient number of single and isolation patient beds to accommodate increasing patient acuity.

Patient care units should be decentralized into smaller clusters that contain decentralized nursing substations, provide increased visibility of patient beds and reduced congestion.

Nurse servers should be located adjacent to patient rooms to provide immediate access to supplies. Traffic on the unit should be reduced through the use of supply holding areas and through the use of large patient rooms that can accommodate family members. Space should also be provided for ancillary and support services.

Each patient care floor should consist of two to three patient units. Support shared by all units on the floor should be included.

Implications of Findings

Efficient hospital design includes clusters of single-occupancy patient rooms and nursing substations to serve these clusters.

Bobrow, M. & Thomas, J. (1994, November 21). Hospitals' prosperity should be by design. *Modern Healthcare*, 24(47), 54.

Focus of Article	To describe trends in designing hospitals.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>Many hospitals need to redesign their facilities to reflect the requirements of a changing market. The hospital environment needs to be less institutional and more consumer friendly. Hospital wings should be redesigned to include more ambulatory care facilities and less inpatient services. Multibed units will be replaced by larger single patient rooms with the capabilities for bedside care as well as space to house family members. Clusters of small nursing stations will be responsible for pods of four to eight beds. Tracking records and computerized patient records will help increase nursing efficiency in single rooms.</p> <p>The flexibility of private rooms outweighs the costs, as fewer beds are need in hospitals. Single occupancy rooms also increase patient comfort and privacy and enable family members to partake in the care of patients.</p>
Implications of Findings	The key to future designs is flexibility. Rooms of the future should be larger and should be single occupancy to increase patient comfort as well as increase privacy and accommodate family members.

Brown, P. & Taquino, L. (2001). Designing and delivering neonatal care in single rooms. *Journal of Perinatal Neonatal Nursing*, 15(1), 68-83.

Focus of Article	To outline the design and outcomes of a neonatal intensive care design project.
Type of Healthcare Facility	The material presented in this article applies to the neonatal intensive care unit at Children's Hospital and Regional Medical Center in Seattle, Washington.
Recommendations for Healthcare Setting	<p>Clusters of single occupancy rooms around a central nursing station was the design chosen for this unit. This design improved the ability to control each individual infant's environment. Variable lighting, decreased noise, and the individualization of patient spaces were easier to achieve. Carpeted finishes, sound-absorbent ceiling tiles, and the placement of larger staff work areas outside patient rooms contributed to decreased noise levels. The flexibility to provide care to patients in the various developmental stages is increased in single rooms, as is the ability to perform critical procedures without impacting other patients. Family-centered care is also enhanced as room is provided for family members to partake in the patient's care. Privacy is also increased and conferences can occur between physicians and family members at the patient's bedside.</p> <p>This design also benefits staff members as visibility is increased through low desks, counters, and walls. Sliding doors between patient rooms enable the nurses to view neighboring patients. Staff members wear locator badges to facilitate communication between them.</p>
Implications of Findings	Rooms on the neonatal intensive care unit are single occupancy and this design has benefits for patients, staff members, and family members.

Brown, W. J. (1994). Big design changes on small budgets. *Nursing Homes*, 43(7), 37.

Focus of Article	To describe how a patient's room should be personalized within a health-care facility.
Type of Healthcare Facility	The suggestions within the article apply to Extended care facilities in the United States.
Recommendations for Healthcare Setting	Brown suggests that a problem with semi-private rooms is that both beds are placed against the same wall with only one resident able to be placed next to the window. A solution to this problem is to place both beds on opposite walls or direct both beds toward the window. If room permits, a table and chair can be placed by the window to provide residents with an exterior view. The room should include tack boards to enable the resident to personalize the space with photographs or mementos. When painting, a variety of colors and textures that are compatible should be used, with light colors against dark colors being more visible. An emphasis wall can be included to add color and visual interest and should be directly visible to both patients. Blinds and curtains on windows provide privacy. When doors are painted, the color should be compatible with, but contrasting from, the surrounding wall color. Within the facility itself, corridors should each have their own unique character and should include single-color carpeting, the nursing station should invite interaction between staff and residents, and the sitting rooms should be designed like family living rooms with small groupings of sofas and chairs to encourage interaction. Artwork, plants, and appropriate lighting should also be used.
Implications of Findings	Semi-private rooms can be designed to promote a home-like environment. Patient interaction is encouraged while still enabling residents to have their own unique space. A comparison with single-occupancy rooms was not provided.

Burmahl, B. (2000, February). Facilities of the future: New designs put patients first. *Health Facilities Management*, 13(2), 30-34.

Focus of Article	To describe trends in healthcare design.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>The trend in healthcare is towards an increase in outpatient services. The number of short-stay hospitals is also increasing, as they offer more services than outpatient services. Patients may stay for several hours of observation to 72-hour stays.</p> <p>Most inpatients are seriously ill, and thus, hospitals are more likely to build critical care beds than intermediate care beds. To make nursing more efficient, nurse stations are being decentralized in that charting stations are located at the patient's bedside. Patient rooms are also being built larger to accommodate family members.</p>
Implications of Findings	The trend in hospitals is to build larger private rooms to accommodate the changing needs of patients.

Carpman, J. (1992). Design research: Emerging trends. *Journal of Healthcare Design*, 5, 97-111.

Focus of Article	To describe how research can aid in the process of designing hospitals.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>Design is viewed as a marketing tool, as it can attract or repel patients from a particular facility. Design can also affect the well being of patients and visitors and it can help prevent illness and injury. Since family care is important to the patient's treatment, space should be allotted to the needs of visitors to ensure they have some privacy and escape. Family members' cognitive and emotional needs should be met. Hospital design should also incorporate the Americans with Disabilities Act (ADA), which requires hospitals to remove barriers that prevent physically handicapped people to have equal access to the facility. A universal design emphasizes independence and safety as well as adaptability over time. Warm and cool colors can be used in the healthcare setting if used knowledgeably. A person's cognitive abilities should be considered in the design so that it does not become too complex to navigate or find one's way. The use of windows is also important to create a positive environment. Hospital design should be pragmatic, it should be based on the needs of the users, it should be reviewed periodically, and it should undergo a systematic postoccupancy evaluation. A participatory design process should also be included.</p>
Implications of Findings	Hospital design is critical to patient satisfaction. No mention was made in regards to room occupancy.

Cawood, C. (1993). Nursing units and common staffing problems. In D. K. Hamilton (Ed.) *Unit 2000: Patient beds for the future. A nursing unit design symposium* (pp. 103-109). Houston: Watkins Carter Hamilton Architects, Inc.

Focus of Article	To discuss the designs of nursing units.
Type of Healthcare Facility	The designs identified in this component of the symposium apply to Rochester Methodist Hospital in Rochester, MN, Scott and White Hospital in Temple, Texas, and the Kaiser Foundation hospital in Panorama City, California.
Recommendations for Healthcare Setting	<p>Smaller patient units are more costly per patient per day, as a higher mix of registered nurses is used and patients with higher than average acuity are being treated.</p> <p>One possible unit design is radial. This design reduces travel distances and times in comparison to single- and double-corridor units. The majority of nurses, if given the choice, would prefer to work on radial units. Radial units, however, cannot accommodate a sufficient number of private rooms without wasting a large amount of central core space. Lateral expansion of these units is also difficult.</p> <p>The triangular shape decreases travel distances while enabling a capacity of 30 to 36 beds. This helps to reduce staffing problems. The utilization of two nursing stations helps to increase visibility into more patient rooms.</p> <p>Flexibility in functionality of patient rooms and nursing units is critical to design.</p>
Implications of Findings	With the increase in demand of private rooms, radial units are no longer an effective design, as this design cannot accommodate a large number of private rooms.

Che, P. (2002). Solucient report forecasts 46% jump in demand for hospital beds in U.S. *AHA News*, 38(44), 6.

Focus of Article	To present the results of a study conducted by Solucient on hospital needs in the United States in relation to the demand for beds and the impact of demographic changes on acute care.
Type of Healthcare Facility	The findings pertain to all hospitals in the United States
Recommendations for Healthcare Facility	The demand for beds in the United States is expected to increase by as much as 46% over the next 25 years. Factors contributing to this increase are the age of the baby boom generation, increased life expectancy, rising fertility rates, and continued immigration. Inpatient demand is expected to grow fastest in the Western and Southern states. The demand is expected to grow more slowly in the Midwestern and Northeastern regions.
Implications of Findings	The inpatient demand is going to increase in upcoming years. There was no mention made in this article, however, in reference to single or multiple room occupancy

Coile, R. Jr. (1997). Competing by design: What you need to know about tomorrow's business in healthcare. *Journal of Healthcare Design*, 9, 25-26.

Focus of Article	To describe changes that are occurring to the healthcare system based on a shift in capital expenditures and investments.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	The healthcare industry is experiencing a shift of capital investments from inpatient care to ambulatory care and non-acute facilities as well as other continuum-of-care facilities. A priority is being placed on creating cost and clinical efficiency to create a sustainable healthcare system. Community health information networks will also be universal.
Implications of Findings	The healthcare industry is shifting from inpatients services to continuum-of-care services. No mention was made in regards to room occupancy.

Contemporary Longterm Care (1997, August). A room of one's own. *Contemporary Longterm Care*, 20(8), 14.

Focus of Article	To present the results of a survey conducted by the American Association of Retired Persons in regards to private and shared occupancy rooms.
Type of Healthcare Facility	The material presented in this article applies to assisted living facilities in the United States.
Recommendations for Healthcare Setting	Of those surveyed, 82% of people would prefer a private room, 4% would prefer a shared occupancy room and 14% either did not know or did not care. Women and people from the western United States were the most likely to prefer a private room. Those of low and high incomes had the same preference for private rooms.
Implications of Findings	Most people surveyed would prefer to stay in a private room in an assisted living facility.

Cys, J. (1999, March). Want healthy patients? Ambience may be the answer. *AHA News*, 35(12), 9.

Focus of Article	To review design factors that can impact the outcome of patients.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	When the environmental design of hospitals is good, patient outcomes can improve. Excess noise, for instance, can elevate the patients' blood pressure and heart rate and can result in sleep loss. To reduce noise, ceiling heights and types can be varied. The use of carpeting also helps lower noise levels. Air quality can also be affected if vents are placed improperly. Sunlight exposure has a positive impact on patients and can help reduce depression. Positive distractions are offered by nature scenes, outside spaces, plants, indoor atriums and windows. In private rooms, beds should be placed on an angle so that patients can focus on the view outside rather than the corridor. Finally, seniors tend to walk faster and better on carpeted floors.
Implications of Findings	Environmental factors can impact the outcome of patients. In private rooms, the placement of the bed to face the outside rather than the corridor can be a positive element of design.

Downing, K. (2002). Patients' perspective central in drawing Planetree model. *Modern Physician*, 6(4), 19.

Focus of Article	To provide background information on the Planetree model of healthcare.
Type of Healthcare Facility	This article pertains to Planetree based hospitals in the United States.
Recommendations for Healthcare Facility	Planetree hospitals have been on the rise since 1998, when the organization had only 15 affiliates. The number of affiliates has now increased to 55. Their model includes the architecture and design of the rooms based on the patients' perspective. Double rooms are used and are set up so that both patients have a window view. Soothing artwork hangs on the walls and shelves are available to hold photographs and other personal belongings. Room controls are installed by the bed. Planetree has tried to make the affiliation cost-neutral. The model relies on a large number of volunteers.
Implications of Findings	While the article mentions the use of double-occupancy rooms, no reason is given and empirical evidence for their use is not provided.

Duffin, C. (2002, May 29). Private rooms in hospital 'would hasten recovery'. *Nursing Standard*, 16(37), 8.

Focus of Article	To discuss the preference of architects for single occupancy rooms.
Type of Healthcare Facility	The information presented in this hospital is pertinent to hospitals in England.
Recommendations for Healthcare Setting	The architects commissioned by ministers suggest that all patients should have single occupancy rooms monitored by nursing sub-stations. Recovery of patients would be quicker due to less exposure to noise, better sleep, and greater privacy. The logistical problems of fitting patients together are not an issue with single occupancy rooms. Patients would also receive most treatments in their rooms, and thus, space surrounding the bed should be large enough to accommodate necessary equipment. Monitoring of patients is not difficult if the rooms are placed in clusters with glass fronts. Infection control is greater with private rooms.
Implications of Findings	Recommendations are made for private rooms due to their benefits to patients.

Edgman-Levitan, S. (1997). Through the patient's eyes. *The Journal of Healthcare Design*, 9, 27-30.

Focus of Article	To describe elements of hospital design that the Picker Institute found critical to patient satisfaction.
Type of Healthcare Facility	The material presented in this article applies to the Picker Institute in Boston.
Recommendations for Healthcare Setting	The mission of the Picker Institute is to promote quality assessment and improvement strategies that address the needs of the patients and their family members. Patients want to be involved in the decision-making process, and they want their cultural values and religious beliefs respected. Patient satisfaction with care is determined by their physical comfort, information and education, and respect for their preferences. Hospital design should include wayfinding and signs, emotional support (ex. artwork, windows, & noise control), gardens and plans, meditation space, private areas, music, comfortable beds and chairs, bedside tables, and places for alternative tables, among other features. Patients can receive information and become educated on their illnesses through bedside computers, patient learning centers, tape recorders, family members, and patient lounges.
Implications of Findings	Patients' satisfaction is dependent upon their level of physical comfort, the information and education received, and respect for the patients' preferences. No mention was made in regards to room occupancy.

Fishback, B. W. & Krewson, C. (1981). Design team simplifies interiors to aid patient recuperation. *Hospitals*, 55(4), 151-156.

Focus of Article	To describe the ward design of Vanderbilt University Medical Center.
Type of Healthcare Facility	The information presented in this article applies to Vanderbilt University Medical Center in Nashville, Texas.
Recommendations for Healthcare Setting	The design principles for this project sought to combine sophisticated design with the needs of the patients. One goal was to simplify elements that are chaotic and disorienting. Patient rooms were painted off-white, floors were carpeted and wardrobes were built into the walls. The layout is modified octagonal and patient rooms are located along the periphery. Nurses' stations, as well as other support spaces, were contained within the service core.
Implications of Findings	No mention was made in regards to room occupancy.

Fisher, S. (1982). Design reduces nurses' walking, encourages patients to visit with each other. *American Health Care Association Journal*, 8(2), 40-43.

Focus of Article	To discuss the design of a nursing home.
Type of Healthcare Facility	The information presented in this article applies to the Christian City Convalescent Center, near Union City, Georgia. It is a 200-bed nursing home.
Recommendations for Healthcare Setting	<p>Two frequent complaints made by nurses in nursing homes are that they have tired feet and that patients have a tendency to gather around their workstations.</p> <p>The design of this facility incorporates a square structure. Rooms are located around the perimeter, and patient rooms are located within 45 feet of the nurses' station. Patient bathrooms are located on the exterior walls, and this feature enables nurses to observe patients without entering the patient room.</p> <p>This design maximizes the use of space, increases the intensity of patient care, and makes the facility feel less institutional. Less walking is required to get anywhere within the facility. Nurses have to walk less and visitors have an easier time locating the patients. Morale is high and turnover is low among registered nurses, partly because of the reduced amount of walking that is required.</p> <p>Lounges are designed to be conducive to socializing, as an open space is located at each corner of the square.</p>
Implications of Findings	The compact design of this facility reduces the amount of traveling done by nurses. No mention was made in regards to room occupancy.

Forman, A. D., Stoller, J. K., & Horsburgh, C. R. Jr. (1996, February 1). Healing by design. *The New England Journal of Medicine*, 334(5), 334-336.

Focus of Article	To offer commentary on the article written by C.R. Horsburgh Jr. (1995).
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>A. D. Forman suggests that medical economic pressures are influencing hospital design. Money is being spent on elaborate designs while staff are being cut to improve bottom lines. The key to managing medical problems, he suggests, is through skilled and labor-intensive care.</p> <p>J. K. Stoller suggests that hospital design should optimize coordination among health care staff. Face-to-face interaction should be encouraged and alcoves in hallways can facilitate the occurrence of private conversations.</p> <p>C. R. Horsburgh Jr. replies that health care providers should be included in health care design to prevent unnecessary expenditures.</p>
Implications of Findings	No mention was made in regards to optimal room occupancy.

Francis, S. (2002). The architecture of health buildings: Providing care - Can architects help? *British Journal of General Practice*, 52(476), 254-255.

Focus of Article	To describe future trends in designing hospitals.
Type of Healthcare Facility	The material presented in this article applies to hospitals in England.
Recommendations for Healthcare Setting	Hospital design has addressed the functional needs of a clinical environment, but has not been comforting or inspiring for patients. A shift has been recently occurring towards a patient-centered design. Hospital designs should be functional, durable and robust, and therapeutic. New buildings will accommodate multidisciplinary teams and include healthy living centers, information kiosks, and social and advice centers. Distinctive characteristics will be created for public, social, and private spaces. A good design should relieve stress for staff members and reduce anxiety for patients.
Implications of Findings	Designs should benefit patients and staff members. No mention was made in regards to room occupancy, though it was mentioned that private spaces are needed for treatments and consultations to offer the patients privacy and maintain their dignity.

Fromhart, S. G. (1995). Will shared rooms in LTC facilities become a thing of the past? *Contemporary Longterm Care*, 18(6), 26.

Focus of Article	To address the issue of private versus shared rooms in long-term care facilities. Long-term care administrators give their opinions.
Type of Healthcare Facility	Administrators from three long-term care facilities in the United States give their opinions. These facilities are the Schoellkopf Health Center in Niagara Falls, New York, the Beth Shalom Home of Eastern Virginia in Virginia Beach, Virginia, and Capital Senior Living in Dallas, Texas.
Recommendations for Healthcare Setting	<p>In New York, Patricia W. O'Connor suggests that private rooms are best because there are no "roommate" problems and families can freely visit and decorate their loved one's room. The increased costs are justified by the improved quality of life.</p> <p>In Virginia, Charles Weiden suggests that single rooms are for private paying residents. Until government funding improves, semi-private rooms are the "cost-effective" standard. Most people in nursing facilities, however, would prefer a private room if given the choice.</p> <p>In Texas, Fred Tanner suggests that shared living arrangements are cost-effective. He does suggest that an alternative to a single apartment is a low-cost two-bedroom apartment-type situation in which two people share a common room and have separate, walled bedrooms. Smaller facilities might benefit from having fewer units in order to control costs.</p>
Implications of Findings	Privacy is an important issue for long-term care patients. While most prefer a single-occupancy room, it is cost-effective to have shared rooms. No empirical evidence was provided to support these recommendations.

Gallant, D., & Lanning, K. (2001, November). Streamlining patient care processes through flexible room and equipment design. *Critical Care Nursing Quarterly*. 24(3), 59-76.

Focus of Article	To describe the design of acuity-adaptable rooms in hospitals.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	The room is designed to support the complete range of care needed for the population it is intended to serve. This type of room must be able to serve both critical care patients as well as recovering patients and their family members. The rooms are private and are large enough to accommodate critical care equipment, staff, procedures, and family members. The organization of space is critical, and to increase hallway wall space in rooms, the bathroom should be located on the exterior room wall. Clinical activities occur on the hallway side of the room.
Implications of Findings	Acuity-adaptable rooms are large and private and are able to serve the needs of the patients as well as their family members.

Garber, K. (1999, February). Doctored design. *Hospitals and Health Networks*, 73(2), 26.

Focus of Article	To describe revisions made by the Joint Commission on Accreditation of Healthcare Organizations to their manual.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	It is suggested that hospitals be designed to create warm environments that support patient dignity as well as create awareness among staff. Elements of nature should be used in hospitals to help brighten rooms and make people feel better. Wayfinding, including signs and visual clues, should also be used to help people get around. This can help reduce the anxiety of patients, which in turn, improves their attention span and treatment compliance.
Implications of Findings	Hospitals should include wayfinding and elements of nature to help patients feel better and increase their compliance to treatments. No mention was made in regards to room occupancy.

Gilpin, L. (1996). Acute Care Design: A workshop on patient-centered environments. *Journal of Healthcare Design*, 8, 41-46.

Focus of Article	To describe how healthcare is moving from the Industrial Age to the Information Age.
Type of Healthcare Facility	The information in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>This article summarizes what was discussed at a workshop on patient-centered environments. It was suggested that the goal of the Information Age is not information, but knowledge. Information is integrated to create health. Patients are becoming partners and are taking personal responsibility for their health. They are making decisions about treatment options that technology offers. People (patients, families, and staff) will always be more important than information. The Planetree organization has developed a variety of techniques that encourage the facilitation of change among healthcare providers and design professionals.</p> <p>Social support needs to be encouraged in care and people must make the best use of treatments and preventative care that requires less technology and expense. Opportunities also need to be created for learning. Finally, every person should feel valued and nurtured despite cultural and ethnic differences.</p>
Implications of Findings	Patients are taking more control in their healthcare. No mention was made in regards to a preference for private or shared inpatient rooms.

Glanville, R. (1996, November). Northern exposure. *Hospital Development*, 27(10), 17-19.

Focus of Article	To describe the design of a Swedish hospital ward.
Type of Healthcare Facility	The information presented in this article applies to Norrtälje Sjukhus, a hospital in Sweden.
Recommendations for Healthcare Setting	The patients' experience in this hospital is meant to be comfortable and home-like. Patients are encouraged to progress from their private bed space through a variety of areas with opportunities for social activity. The inpatient area is divided into twenty-four bed groups, and these are arranged in three subgroups of eight, each with its own nursing team. Each subgroup consists of a three-bed room, a two-bed room, and three single bedrooms, each with its own en suite bathroom. Folding screens are provided for individual bed privacy and each patient has a view from his or her bed. Staff facilities are provided for the nurses and staff members are expected to take relaxation breaks while on the ward.
Implications of Findings	Though a variety of occupancy rooms are used, patients are given their own space to ensure they have the privacy they need.

Graven, S. N. (1997). Clinical research data illuminating the relationship between the physical environment and patient medical outcomes. *Journal of Healthcare Design*, 9, 15-20.

Focus of Article	To describe how the environment in the neonatal intensive care unit can be modified to better suit the needs of infants.
Type of Healthcare Facility	The material presented in this article applies to neonatal intensive care units.
Recommendations for Healthcare Setting	It is suggested that the elements in the neonatal intensive care units can affect infant development. Infants have limited defense from bright light, and thus the use of focused lighting and dimmer controls can aid in individualizing light levels for infants based on their needs. Infants exposed to high levels of background noise may suffer from an interference with the development of frequency discrimination as well as sound pattern recognition. Noise levels can be reduced by adding sound-absorbing surfaces, incorporating silent alarms with blinking lights, and using paging systems with vibrators.
Implications of Findings	Environmental factors within neonatal intensive care units can affect the development of infants and thus, care should be taken in designing the environment to suit the infants' needs. No mention was made in regards to room occupancy.

Hahn, J. E., Jones, M. R., & Waszkiewicz, M. (March, 1995). Renovation of a semiprivate patient room. Bowman Center Geriatric Rehabilitation Unit. *Nursing Clinics of North America*, 30(1), 97-115.

Focus of Article	To discuss the renovations made to two semiprivate rooms in a geriatric unit.
Type of Healthcare Facility	The facility described in this hospital is the Geriatric Rehabilitation Unit in the Johnston R. Bowman Health Center for the Elderly at Rush-Presbyterian-St. Luke's Medical Center.
Recommendations for Healthcare Setting	<p>Total quality management strategies, which include statistical techniques, brainstorming, indicator development, monitoring, and evaluation, were used to aid the renovation process. It was determined that the primary functions of patient rooms are: patient care, nursing care, medical treatment and therapy; activities of daily living; examinations and evaluations; socializing; sleeping; and cleaning and repair. Problems identified with the rooms were inadequate storage, as well as sensory-related issues. Rooms were modified to increase storage, to maximize the diminishing visual abilities of the elderly (through window sheers, nonglare light-colored flooring, and floor molding), and to provide a warm, homelike appearance (through a custom wardrobe, vinyl flooring that looked like hardwood flooring, privacy curtains, and window treatments).</p> <p>To evaluate the designs, surveys were collected from patients over a period of three months. Based on the responses, customer satisfaction rose significantly.</p>
Implications of Findings	Semiprivate patient rooms were successfully modified to create a more aesthetically pleasing environment for patients.

Hendrich, A., Fay, J., & Sorrells, A. (2002, September). Courage to heal: Acuity-adaptable patient rooms and decentralized nursing stations-A winning combination. *Healthcare Design*, 11-13.

Focus of Article	To describe the design of the Critical Care Unit at Methodist Hospital
Type of Healthcare Facility	The material presented applies to the Comprehensive Cardiac Critical Care Unit in Methodist Hospital of Clarian Health Partners in Indianapolis.
Recommendations for Healthcare Setting	<p>Based on data from a time-and-motion study on a nursing unit, it was discovered that patients in the hospital were moved between three and six times due to changes in their acuity levels. Multiple caregivers were used for one patient and, as a result, tasks were duplicated and error rates increased. Nurses were also traveling long distances each shift to find supplies. A highly flexible environment was created with private rooms that supported the changing levels of acuity in patients. Rooms are 400 square feet and are divided into three areas: a family zone, a patient zone, and a caregiver zone. Equipment and supplies are easily accessible for staff members and patients can control lighting, temperature, and privacy as their condition improves.</p> <p>Initial baseline data indicates that unit-to-unit transfers have decreased by 90 percent. Overall patient days per bed have increased since the patient is not required to move. Patient falls and medication errors have also decreased and patient safety has improved with the decentralized nursing stations.</p>
Implications of Findings	The acuity adaptable rooms have helped improve clinical outcomes, cost and operational efficiency, and staff and patient satisfaction.

Hewitt, T. & McFarlane, J. (1997, August). The wards. *Hospital Development*, 28(7), 24.

Focus of Article	To describe the wards of Leeds General Infirmary (Phase One) in terms of the location and size of the wards as well as the environment provided for the patients.
Type of Healthcare Facility	The facility described in the article is Leeds General Infirmary in England.
Recommendations for Healthcare Setting	The maximum capacity of the wards described is twenty-eight beds, with four-bedded bays being the maximum allowed in the bed areas. Each bed bay has exclusive use of a shower and toilet, and thus, each ward can accommodate both sexes. On most wards there are four single rooms, and some of these rooms contain ensuite facilities. Large windows are used at low levels, enabling patients to see the outside from their beds. Each floor also has a clean and dirty hold area to help minimize congestion on corridors. Day spaces are distributed around the ward and are small and friendly.
Implications of Findings	The design incorporates the use of both single and multiple bedrooms and a preference for either type of room is not mentioned.

Hill-Rom (2002). *The patient room of the future*. IN: Hill-Rom Publications.

Focus of Article	To describe the benefits of the acuity adaptable room.
Type of Healthcare Facility	The material presented in this article applies to U.S. hospitals.
Recommendations for Healthcare Setting	<p>Changing trends in healthcare include an aging population, and thus, treating patients requiring higher acuity care. In regular hospitals, patients requiring high acuity care are generally admitted through the emergency department, then transferred to the critical care unit, and then transferred again to the medical-surgical ward. The use of the acuity adaptable room reduces the need for transferring patients, since patients can receive all the required care in one room regardless of their acuity level.</p> <p>The acuity adaptable room is larger in size than a regular hospital room. Patient visibility from the corridor is possible, and space is provided for visitors. In facilities that are using this type of room, medication errors, patient falls, phlebitis, and procedural and lab errors have all decreased. The average length of stay for the patient has also been shorter when staying in the acuity adaptable room.</p>
Implications of Findings	The acuity adaptable room is single-occupancy and reduces the need for patient transfers, since the patient receives all the necessary treatments in one room.

Hohenstein, J. (2001, December). Facility profile. *Health Facilities Management*, 14(12), 12-13.

Focus of Article	To describe the newly constructed Children's Hospital in Omaha, Nebraska.
Type of Healthcare Facility	The healthcare facility featured in this article is Children's Hospital in Omaha, Nebraska.
Recommendations for Healthcare Setting	<p>The exterior of Children's Hospital is inviting and uplifting with the use of bright colors such as peach, beige, and gray brick. On the interior of the hospital, themes are drawn from the environment of Nebraska. Within the 130-bed facility, diversion and entertainment play an important role. Game rooms are located on every floor and art created by the children hangs on the walls. The patient floors are curved, dividing the nursing duties into six-room pods. The equipment is centralized in the inner nursing area of the pod, and the curved layout is less cluttered and quieter than the long, straight-hall design, according to the nursing director. All the patient rooms on the medical and surgical floors are single occupancy, ensuring privacy and reducing the risk of spreading contagious illnesses. Rooms are designed to look like a child's bedroom at home and include a parent bed, a refrigerator, a wardrobe, a satellite television with a VCR and a data port allowing parent to access the Internet. For parents of long-term patients, separate sleeping rooms are available. Natural light is used extensively throughout the hospital, but when it is impossible, indirect light is used to create a less harsh environment.</p>
Implications of Findings	The article suggests a preference for single occupancy rooms to give the family privacy and to help reduce the spread of infectious illnesses.

Horsburgh, C. R. Jr. (1995). Healing by design. *The New England Journal of Medicine*, 333(11), 735-740.

Focus of Article	To describe current trends in hospital design that focus on patients and their families.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>Hospital design has recently begun to focus on patients and their families. There is increasing competitiveness in the health care industry, and pleasant facilities can help attract patients. Four qualities of space characterize good architecture: orientation, connection, scale, and symbolic meaning.</p> <p>Orientation refers to the patient's ability to find and gain entrance into the building as well as to locate one's destination within the building. Entrances should be clearly identifiable, and signs, visual cues, and landmarks can help a person orient oneself.</p> <p>Connection describes the quality of interaction between people and their environment. Lobbies should be open and inviting and alcoves in lobbies enable private conversations to occur. Windows with views of nature have positive influences such as reduced stress in employees. Social spaces are also included in designs.</p> <p>Scale encompasses the relationship between the size of the architectural forms and the patient. Scales should be modified to provide variety, to accent changes in ambience, and to define the progression from public spaces to private spaces.</p> <p>Hospitals should also be designed to convey the symbolic meaning of security, cleanliness, and physical comfort.</p>
Implications of Findings	Hospital design should include a balance between function and good architecture. No mention was made in regards to room occupancy.

Hosking, S. & Haggard, L. (1999). Patient wards. In S. Hosking and L. Haggard, *Healing the hospital environment: Design, management and maintenance of healthcare premises* (pp.70-73). London: Routledge.

Focus of Article	To describe the advantages and disadvantages of the Nightingale and Bay wards.
Type of Healthcare Facility	The material presented in this chapter applies to all hospitals.
Recommendations for Healthcare Setting	<p>In the Nightingale ward, beds are arranged down each side of a long, narrow ward. The nursing station is located on one end of the ward, while the convalescent bay is located at the other end. Nurses are able to monitor patients with relative ease. This ward became unpopular, however, because the patients' need for privacy was not met.</p> <p>Newer designs include bay wards, which subdivide wards into four-, six-, or eight-bed bays. This type of design offers patients more privacy and intimacy, and it is more flexible. Patients can be clustered according to sex or illness. This ward also has some disadvantages. The patients' view of the nurses is limited, and thus, the patient is unaware of what the nurse is doing. This can increase the patients' anxiety if they are trying to call the nurse and the nurse does not respond quickly. Patients also feel confined to their bay and are hesitant to approach other patients not on their bay. New sources of noise appear on this ward through the use of more equipment and open and longer visiting hours. Nurses also find it harder to be more vigilant about the noise.</p>
Implications of Findings	The Nightingale wards and bay wards have advantages and disadvantages. Rooms on these wards are multiple-occupancy.

Jones, W. (1995). Acute care design: emerging trends. In S. O. Marberry (Ed.), *Innovations in healthcare design: Selected presentations from the first five symposia on healthcare design* (pp.12-20). New York: John Wiley & Sons, Inc.

Focus of Article	To discuss emerging trends in healthcare facility design.
Type of Healthcare Facility	The material presented in this chapter applies to all hospitals.
Recommendations for Healthcare Setting	<p>Old hospital forms offered basics such as food and shelter, and perhaps some cleanliness. Florence Nightingale inspired the design of wards; she suggested that wards should be long, low pavilions connected by corridors. Windows were located on both sides of the corridor. Modern hospitals were influenced by the invention of the elevator, which allowed the stacking of the Nightingale wards. The central elevator also determined the size of the nursing units and influenced the distance traveled by nurses.</p> <p>Newer, future-oriented designs, incorporate bed clusters to reduce patient travel as well as the number of people associated with patient care. Critical to future designs are adaptability and flexibility. Patient rooms need to be larger, and separable, in order to accommodate patient care.</p>
Implications of Findings	Larger, separable patient rooms that provide both flexibility and adaptability are important for future designs.

Kaldenberg, D. O. (1999). The influence of having a roommate on patient satisfaction. *The Satisfaction Monitor*, (January/February).

Focus of Article	To discuss the impact that having a roommate has on patient satisfaction.
Type of Healthcare Facility	The material presented applies to hospitals in the United States.
Recommendations for Healthcare Setting	Hospitals with more private rooms tend to have higher patient satisfaction. Patients without roommates reported higher levels of satisfaction than those with roommates. In terms of gender, female patients with roommates were less satisfied than males, while female patients without roommates reported higher levels of satisfaction than males. In terms of the environment, patients with roommates were less satisfied with the noise, pleasantness, cleanliness, and temperature of the room.
Implications of Findings	Patient satisfaction is greater for those who do not have a roommate.

Kennedy, S. (1994, March 21). As care delivery evolves, facility design must change. *Modern Healthcare*, 24(12), 38.

Focus of Article	To describe how building design should be flexible to accommodate changes in the long term.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	Due to the shift in outpatient services, inpatient facilities are struggling to survive. Some facilities are incorporating complementary medicine, which attempts to assist the healing process through the patients' mind-body connection. Facilities should be flexible to accommodate both short-term purpose as well as changes that may occur in the long-term with minimum inconvenience and cost.
Implications of Findings	Hospital design needs to be flexible to accommodate changes in the healthcare industry. No mention was made in regards to room occupancy.

Larson, L. (2003, February). Putting safety in the blueprint. Patient safety is the guiding force for a new hospital. *Trustee*, 56(2), 8-13.

Focus of Article	To describe the design of a new hospital whose emphasis is on patient safety.
Type of Healthcare Facility	The information presented in this article applies to St. Joseph's Community Hospital, West Bend, Wisconsin.
Recommendations for Healthcare Setting	All rooms in this facility are private, and all are designed identically. Rooms feature cameras to be used when necessary, with the patient's permission. Nurses will be able to monitor patients from their workstations in an attempt to prevent patient falls. A small alcove adjacent to the patients' rooms will enable nurses to view the patients through a window while simultaneously protecting the patients' privacy. Rooms will also contain a cabinet, which contains the patients' medications, locked in boxes, as well as other supplies necessary to care for the patient. Bedside computers will be used to double-check patient treatment and to enable patients to view their records. Shorter hallways between patient rooms and the nurses' stations will help to minimize employee fatigue.
Implications of Findings	Private rooms are used in this new facility, though specific reasons as to why this is the case are not given.

Leccese, M. (1992). Nature meets Nurture. *Landscape Architecture*, 85(1), 68.

Focus of Article	To describe the design, and in particular, the landscaping of St. Michael's Hospital.
Type of Healthcare Facility	The material presented in this article applies to St. Michael's Hospital in Texas.
Recommendations for Healthcare Setting	The goal for this facility was to create a compassionate setting for healing. The landscape is considered part of the healing process, and thus, the design incorporated jogging paths, fountains, lakes, and trees. Patient rooms consist of floor-to-ceiling bay windows, giving patients views of forests or seasonal plants and flowers. Two courtyards have also been included in the design.
Implications of Findings	This design incorporates the landscape, as it is thought to influence the healing process. No mention was made in regards to room occupancy.

Leibrock, C. A. (2000). Inpatient hospitals: General hospitals. In C. Leibrock, *Design details for health: Making the most of interior design's healing potential* (pp.231-256). New York: John Wiley & Sons, Inc.

Focus of Article	To describe details of design in hospitals.
Type of Healthcare Facility	The material presented in this chapter applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>Ambulatory care facilities are beginning to replace general hospital delivery systems. Tertiary care hospitals encourage the participation of the patient and family members in the decision-making process.</p> <p>The Planetree model empowers patients with research. Patients are given access to libraries and research articles to learn more about their condition. Rooms in these facilities are private, and they are large enough to accommodate the patient as well as the patient's caregiver. The nursing station is decentralized into a series of pods, each of which serves three to four patients.</p> <p>Various features of design have a positive impact on patients. A well-maintained garden, for instance, provides sensory stimulation. Art can help a person develop a heightened sense of self and can free the imagination. Stress can be reduced through the use of wayfinding and scenes of nature, while sound can be a positive distraction. Patients should also have a sense of control over their personal space. Hospitals must comply with ADA requirements.</p>
Implications of Findings	Patient-centered care gives the patients a sense of control, as they are active participants in their care. Room occupancy is mentioned in regards to the Planetree model, where patient rooms are private.

Lippman, H. (1991, July). Is this the ideal hospital? *Registered Nursing (RN)*, 46-47.

Focus of Article	To describe the design of Irvine Medical Center.
Type of Healthcare Facility	The information presented in this article applies to Irvine Medical Center in California.
Recommendations for Healthcare Setting	The philosophy of this facility is patient-centered with a business orientation. All the inpatient rooms are private and are divided into pods of four rooms. A nursing alcove exists for every two pods. This alcove serves as a mini-nursing station where staff members can discuss patients, print records, replenish supplies, and reach patients quickly.
Implications of Findings	The inpatient rooms in this facility are private, but reasons are not given as to why this form of occupancy was chosen.

Lowers, J. (1999, August). Improving quality through the built environment. *Quality Letter for Healthcare Leaders*, 11, 2-9.

Focus of Article	To describe the design of patient-centered hospitals.
Type of Healthcare Facility	The material presented in this article pertains to hospitals that incorporate the patient-centered approach.
Recommendations for Healthcare Setting	<p>Based on focus groups conducted by The Picker Institute, it has been suggested that important factors for patients in terms of a hospital stay are a sense of control, safety, and confidentiality. The built environment should enable patients to connect with staff members, be conducive to the patients' sense of well-being, be convenient and accessible, include private rooms which give the patient privacy and space for family members, be safe and secure, and should foster connections to the outside world.</p> <p>Indirect lighting diffuses light and creates a more natural effect. Carpeted hallways help keep noise to a minimum. Through temperature controls, patients are able to adjust the temperature as needed. Music should be available for patients to help reduce stress. The design should engage the patients' senses. This can be accomplished through the use of plants and outdoor gardens, as well as atrium lobbies and artwork. Nursing stations should be accessible to patients, and thus, should have low counters and no glass. Mini-nursing stations can eliminate the central gathering point. Staff should also be provided with lounges to relax and recover from stressful work.</p>
Implications of Findings	In this design, single-occupancy rooms are preferred as they increase the patients' privacy and confidentiality. Family members also have space to take part in the patients' care.

Lumsdon, K. (1996, November). Bricks, mortar and a whole lot more. *Hospitals and Health Networks*, 70(21), 55.

Focus of Article	To discuss changes made to West Allis Memorial Hospital based on patient satisfaction surveys.
Type of Healthcare Facility	The material presented in this article applies to West Allis Memorial Hospital in Wisconsin.
Recommendations for Healthcare Setting	<p>Patient surveys suggested that patients were unhappy with semiprivate rooms. Complaints were made in regards to noisy visitors, bothersome roommates, and a large amount of traffic both in and out of rooms. This problem will be rectified with the creation of private rooms.</p> <p>Centralized nursing stations will be removed and replaced with smaller satellite pods, which will serve seven to nine patients. Cabinets in alcoves outside patient rooms will store small amounts of drugs and supplies needed for each patient. Patient care associates, a new staff category, will handle support tasks formerly done by nurses.</p>
Implications of Findings	This facility will create private patient rooms to improve patient care.

Lumsdon, K. (1993, February 5). Form follows function: Patient-centered care needs strong facilities planning. *Hospitals*, 67(3), 22-24&26.

Focus of Article	To describe the design of patient-centered Mercy Hospital and Medical Center.
Type of Healthcare Facility	The material presented in this article applies to Mercy Hospital and Medical Center in San Diego, California.
Recommendations for Healthcare Setting	<p>In facilities using the patient-centered care model, inpatient rooms are transformed to reduce the stress of patients as well as give them a sense of control over their surroundings. Rooms at Mercy Hospital and Medical Center are larger to accommodate family members and friends involved in the patients' care. Artwork, paint, and wall coverings are all carefully chosen to be sensitive to the needs of the patients. Rooms also include a patient server, which is a cabinet of drawers and shelves that holds all the supplies a patient may need.</p> <p>The nursing station is decentralized and located at smaller pods throughout the patient unit. Patients are linked to caregiver teams via pagers and one nurse is stationed at a central telephone area to help prevent communication snags between nurses.</p> <p>The facility also includes activity rooms, dining areas, and reference libraries on patient units.</p>
Implications of Findings	Rooms in this facility are large and accommodate family members, though it is not specified if the rooms are private.

McMorrow, E. (2001, March). Have a pebble project? *Facilities Design & Management*, 20(3), 7.

Focus of Article	To describe The Center for Health Design Pebble Project. The purpose of this projects is to provide researched and documented examples of projects that have created life-enhancing environments for patients, families, and staff.
Type of Healthcare Facility	The information presented in this article pertains to the San Diego Children's Hospital and Health Center.
Recommendations for Healthcare Setting	The Center for Health Design (CHD) concentrates on five core areas: environmental standards, education/information, technical assistance, research, and partnerships with selected healthcare organizations. There are two components to the Pebble project. The first is an emphasis on understanding how organizational behavior changes as a result of the planning and design process. The second component is the development of a standardized evaluation methodology, which will enable a comparison of outcomes, the identification of the best practices and continuous improvements in healthcare design.
Implications of Findings	The pebble project is trying to provide the healthcare community with researched and documented examples of projects that have been positive for staff, patients, and their families. No mention was made in regards to a preference for single or multiple room occupancy.

McTaggart, R. (1996, June). Base lines. *Hospital Development*, 27(6), 13.

Focus of Article	To discuss issues relevant to designing hospital wards. The discussion was centered upon the design of a staff base.
Type of Healthcare Facility	The facilities included hospital wards with private rooms in the United Kingdom.
Recommendations for Healthcare Settings	McTaggart found that the main problems with private rooms were that doors did not have observation windows and distracting light was being reflected from the windows. She also felt that the staff base (nurse's station) was the central control point for ward management. Architects suggested that unit size should be increased for cost-reduction to occur. Also, 30-50 % of the rooms should be single rooms. Visibility of the beds from the staff bases should be improved and core ward support services should be moved closer to all beds. The design includes a 34-bed ward with patients being in groups of 12. Rooms are designed to be single or 4-bed. 2 more beds can be accommodated if the stems at the point of the triangle design are filled. Nursing teams have their own staff base and each patient group has their own nursing team.
Implications of Findings	Wards should be designed to include a majority of single-bed rooms with the remaining rooms being 4-bed. This ward design is suggested to reduce time spent by nurses traveling between patient rooms and various supply points. These suggestions are proposed without any mention of empirical or financial evidence to support them.

McTaggart, R. (1996, May). Whose space is it anyway? *HD: Hospital Development*, 27(5), 11-13.

Focus of Article	To discuss ward design in England.
Type of Healthcare Facility	The material presented in this article applies to hospitals in England.
Recommendations for Healthcare Setting	<p>Hospital design should incorporate patient-focused care. The use of the Planetree model, which stresses the importance of the physical environment, is suggested. Ward design should include non-clinical spaces such as quiet lounges and rooms for counseling relatives. Patients should be given the option to move from unwelcome neighbors, their own personal space, and a room to escape for privacy.</p> <p>Two-bed rooms can be designed in an “L”-shape with an en suite toilet. This design can be economical and patients are given their own sense of space. Rooms should have enough bed space allocated to enable bedside procedures to take place.</p> <p>An increased provision of single rooms also exists as a marketing asset and for infection control.</p> <p>Wards should separate the sexes into their own bed bays or rooms and common service areas should not be shared.</p>
Implications of Findings	Two-bed rooms designed in an “L”-shape can be economical and both patients have their own sense of space. The number of single rooms is increasing, though, for infection control as well as to market the hospital.

Mader, B. (November 11, 2002). Private hospital rooms the new norm. *The Business Journal of Milwaukee*. <http://milwaukee.bizjournals.com/milwaukee/stories/2002/11/11focus2.html>.

Focus of Article	To discuss the trend of private rooms in Milwaukee hospitals and the costs and benefits of private rooms versus semi-private rooms.
Type of Healthcare Facility	This article pertains to hospitals in Milwaukee.
Recommendations for Healthcare Settings	Consumers are becoming more vocal and are demanding private rooms in hospitals. Health Management Organizations believe that health care costs are increasing because of these individual expectations. Hospital administrators argue that private rooms are cost-effective in the long run. Patients are sicker now than they were 15 or 20 years ago and they require more intensive care type services. This requires more privacy. Private rooms help to control the spread of infectious diseases and provide a more efficient layout and a safer environment to conduct business. Room usage can increase by as much as 15 percent with private rooms while not sacrificing patient revenue. Private rooms, however, are hard to justify when the patient volume is high. Semi-private rooms have the advantage of using less square footage per patient. The disadvantage of semi-private rooms is that gender and infectious disease issues limit which patients can be placed together in one room.
Implications of Findings	Both patients and hospital administrators prefer the use of private rooms to semi-private rooms. Hospital Management Organizations, however, feel that semi-private rooms are more cost-effective. Empirical evidence was not provided for either argument.

Martin, C. (2000, August 5). Putting patients first: Integrating hospital design and care. *Lancet*, 356(9228), 518.

Focus of Article	To evaluate the 2 nd International Conference on Health and Design that was held in Stockholm, Sweden in June 2000. The premise of the conference was that the physical environment affects well-being.
Type of Healthcare Facility	The article applies to all hospitals.
Recommendations for Healthcare Setting	<p>Roger Ulrich, the chairman of the conference, suggests that stress is the scientific starting point for understanding how design affects medical outcomes. There is international acceptance that the design of healthcare facilities should be human centered, functionally efficient, and should benefit patients, families, and staff members. Architects value a homelike environment in their designs and are critical of healthcare facility design, in particular with difficulties experienced in way-finding in hospitals and poorly designed inpatient rooms.</p> <p>In Trondheim, Norway, for instance, the patient perspective was taken into account and the new regional hospital will have seven clinical centers, each with its own building. This is advantageous because patients will be able to go directly to the building they require and will need to relate with fewer health professionals.</p>
Implications of Findings	The conference emphasized that the patient perspective should be taken into account when designing a hospital. No mention was made, however, in regards to a preference for private or shared inpatient rooms.

Miller, R. L. & Swensson, E. S. (1995). The patient care unit (Chapter 9) New directions in hospital and healthcare facility design (pp.177-208). New York: McGraw-Hill, Inc.

Focus of Article	To describe trends in the design of hospitals.
Type of Healthcare Facility	The material presented in this chapter applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>Patient-focused care was given momentum from the development of the Planetree model in 1978, which sought to improve the human quality of patient care. The open ward is essentially obsolete due to a team approach to care as well as technological developments.</p> <p>The patient room should be a humane environment, which provides the patient with privacy, dignity, cleanliness, and security, among other factors. The needs of the nurses, at times, conflicts with the needs of patients. Their need to have easy access to patients and the ability to see patients, for instance, may impact a patient's privacy.</p> <p>In patient-centered care facilities, rooms are larger and of single-occupancy. The large space allows for the performance of procedures in the rooms and it reduces the necessity of transporting the patient to various specialists. A larger room is also feasible economically, for in the long run, the rooms can be used for rehabilitation and elderly housing or for other programs. Flexibility is also increased through the use of disabled-access bathrooms. This enables all patients to use the rooms at all times. Room space is increased if the bathrooms are located on the outside wall. A design incorporating a cluster of beds, which can readily be supervised by a nursing team, is recommended. It is also easily managed to accommodate fluctuating patient populations.</p> <p>Bedside computers enable more detailed and frequent updating of patient charts to occur.</p>
Implications of Findings	Patient-focused care incorporates single-occupancy rooms which provide for increased flexibility and adaptability to care for an array of patients.

Moore, J. P. (1974). Renovation and expansion of health facilities: Cost primarily determines feasibility. *Hospitals*, 48(3), 111-114.

Focus of Article	To discuss the renovations and expansions that occurred at Methodist Hospital.
Type of Healthcare Facility	The material presented in this article applies to Methodist Hospital, Lubbock, Texas.
Recommendations for Healthcare Setting	Methodist hospital underwent expansion and renovations to solve some of its functional deficiencies, which included a need for single-care bedrooms. Renovations and expansions were chosen over building a new site due to the large costs of creating a new building. A new tower was built and included five floors of patient rooms. Each floor consisted of 38 beds, all in single-care rooms.
Implications of Findings	The new facility includes a large number of single-care rooms, though specific reasons were not given as to why these rooms are preferred.

Morrissey, J. (1998). Planetree model gets new caretaker. *Modern Healthcare*, 28(16), 45.

Focus of Article	To discuss the acquisition of the Planetree organization by Griffin Health Services Corporation.
Type of Healthcare Facility	This article pertains to Planetree based hospitals in the United States.
Recommendations for Healthcare Setting	The Planetree organization was acquired by Griffin Health Services Corporation. Since 1986, only 15 facilities have been converted to the Planetree program. The organization had trouble following up on facilities that showed interest and demonstrating the ongoing benefit of paying an annual \$15,000 licensing fee. The Planetree organization could not guarantee a reduction in costs and greater operating efficiency.
Implications of Findings	The Planetree organization has not performed to its expectations and is now under new management. No mention was made in regards to a preference towards single or multiple room occupancy.

Murphy, E. (2000, March). The patient room of the future. *Nursing Management*, 31(3), 38-39.

Focus of Article	To describe patient rooms of the future, which are designed to promote healing.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	The healing process is affected by light, color, nature, and the ability to control one's environment. Patient rooms of the future will be larger to enhance patient comfort and emphasize patient-centered care. Rooms will include comfortable seating, guest sleeping, and storage to help ease family members. Artwork on walls features nature scenes, and rooms will have controls for lighting, television, and window shades by the bedside. Space around the bed will increase to allow bedside procedures to take place.
Implications of Findings	Rooms of the future are designed to accommodate patients and family members. No mention is made in regards to room occupancy, though the implication is that these rooms are single occupancy to include family members in the treatment of patients.

Napthine, R. (1997-1998, December-January). Should hospital architects test drive wards? *Australian Nursing Journal*, 5(6), 30-32.

Focus of Article	To describe inefficiencies with the layout of the patient's room.
Type of Healthcare Facility	The material presented in this article applies to all hospitals.
Recommendations for Healthcare Setting	<p>While hospitals offer enough space for the patients' safety and comfort, nurses are not given enough space to work effectively. The layout of the patient room, in particular, hinders the ability of nurses to complete their tasks. For instance, the service outlets behind the patients' bed-head are often inaccessible. This problem can be rectified by increasing the number of wall-mounted service outlets to make them more accessible. Another problem is with the towel rails located behind the patient's bed or beside their bedside locker. The towels are often out of reach and nurses are not able to hang a used towel back onto the rail.</p> <p>Other inefficiencies include shallow wardrobes, narrow shelves and doorways, and shallow hand basins. These inefficiencies impact nurses as they may take longer to complete their tasks, or they may injure themselves in the process of performing a task.</p>
Implications of Findings	Efficient layout of the patients' rooms will help nurses perform their tasks more efficiently. No mention was made in regards to room occupancy.

Neumann, T. & Ruga, W. (1995, April). How to improve your unit's environment. *American Journal of Nursing*, 95(4), 63-65.

Focus of Article	To offer some suggestions, based on experience, on how to improve the nursing unit's environment in a hospital.
Type of Healthcare Facility	The information provided in this article applies to St. Luke's Episcopal Hospital in Houston, Texas.
Recommendations for Healthcare Setting	Based on the successful renovations of St. Luke's Episcopal Hospital, the authors have suggested some changes that have improved the quality of healthcare at this facility. Neumann and Ruga suggest that viewing nature scenes can shift a patient's feelings into a more positive state. Their activity levels increase, anxiety is decreased, blood pressure and muscle tension are reduced, and the length of stay is minimized. Natural images, which the patient can see or choose, are best. Plants are popular among staff, patients, and families. Aquariums have also been shown to decrease anxiety and discomfort, while increasing patient compliance. Any unnecessary noise, such as overhead paging (except in emergencies), should be eliminated. Carpeting should be installed to decrease noise and sound-deadening covers should be used for noisy devices. Patients should be encouraged to listen to music and when possible, live music should be brought in to patient units and waiting areas. Soft blankets help to provide a goodnight's sleep. Comfortable seating should be provided for family members and visitors. Ambient temperature should be assessed and negative odors should be eliminated.
Implications of Findings	The authors suggest that a positive environment can have a great impact on the patients. No mention was made in regards to a preference for private or shared inpatient rooms.

Noakes, T, Glynis, M. (1998, October). King's cross stations. *Hospital Development*, 29(9), 24-26.

Focus of Article	To describe the proposed ward design for the Millennium Hospital in New South Wales.
Type of Healthcare Facility	The material presented in this article applies to Millennium Hospital in King's Cross, New South Wales.
Recommendations for Healthcare Setting	The ward design in this facility includes continuous bands of at least 200 beds on each floor. Wards are divided into clusters of eight beds, including one four-bed room and four single bed rooms. Each cluster also has its own nursing station and supply trolley, reducing the amount of time traveled by a nurse. Rooms contain drug cupboards with the prescriptions needed by each patient. Beds are spaced wider apart to facilitate bedside treatment and to help reduce the risk of infection. An increase in the number of single rooms is also suggested to help control the risk of acquiring an infection.
Implications of Findings	The ward design in this facility will include a combination of single and multiple occupancy rooms. A larger number of single occupancy rooms is needed to help reduce the risk of acquiring an infection.

Orr, S., Farrell, J., & Portman, F. (2002, August). Room to improve? *Nursing Standard*, 16(47), 20-21.

Focus of Article	To describe viability of single occupancy rooms based on the perspective of nurses.
Type of Healthcare Facility	The information presented in this article applies to hospitals in England.
Recommendations for Healthcare Setting	<p>Orr suggests that single rooms are not viable for all patients. Acutely ill patients need constant monitoring, and if staffing is not increased, mortality rates may increase, as patients may not be able to attract attention when help is needed in single rooms.</p> <p>Farrell believes that the security and safety of patients is an issue in single rooms as they are harder to monitor. Bed capacity would also be reduced with single rooms. Overall, single rooms are not practical for hospitals.</p> <p>Portman feels that patients in single rooms may become 'invisible' since monitoring them is more difficult. Costs would also increase as wards would have to be redesigned and staff would have to increase. She states that patients, when asked, prefer to stay on ward where their psycho-social needs are being met through contact with other patients.</p>
Implications of Findings	From the perspective of nurses, single occupancy rooms are not practical, as the safety and security of patients is placed in jeopardy.

Patterson, M. (1999, July). Smooth healing. *Buildings*, 3(3), 16-17.

Focus of Article	To describe the features of the Cardiac Comprehensive Care Unit at Methodist Hospital in Indianapolis.
Type of Healthcare Facility	The material described in this article applies to the Cardiac Comprehensive Care Unit at Methodist Hospital in Indianapolis.
Recommendations for Healthcare Setting	The rooms were designed with the staff, patient, and the patient's family members in mind. Computers are located outside each patient room, enabling the nurses to easily input patient information. The windows of the patient rooms are angled, giving the nurses the ability to view into three patient rooms simultaneously. Patient rooms are private, and patients have shelving in the rooms to keep personal material. Within these rooms, family members have their own space equipped with a sleeper sofa, a dresser, a desk, a refrigerator, a telephone, and a computer. There are also spaces outside the patient rooms where family members can be alone. Interior gardens are included in the design.
Implications of Findings	Patient rooms are private and large enough to accommodate family members who are willing to participate in the patient's care.

Rainey, J.B. (1990, May 19). Requiem for a ward. *BMJ: British Medical Journal*, 300(6735), 1347.

Focus of Article	To describe the effects of moving from an open ward to a bay ward.
Type of Healthcare Facility	The material presented in this article applies to a hospital in Scotland.
Recommendations for Healthcare Setting	A move was made from a facility that included open wards to a facility that included six-bed bays as well as single occupancy rooms. This transition was a difficult one as patients had to be moved around on the bay wards and a great deal of time is spent tracking down patients. Privacy is also an issue in the bay wards and counseling cannot occur in the patient rooms, as conversations are audible to others. The opposite was true on the open wards. The patients in the single rooms can feel lonely and isolated. The open ward, on the other hand, offered patients a chance to interact with one another.
Implications of Findings	A preference is suggested towards open wards as privacy is increased and patients have the opportunity to interact with one another.

Shumaker, S.A. & Pequegnat, W. (1989). Hospital design, health providers, and the delivery of effective health care. In E. H. Zube & G. T. Moore (eds.), *Advances in environment, behavior and design (Volume 2)* (pp.161-202). New York: Plenum Press.

Focus of Article	To discuss elements of design that can influence patient stress.
Type of Healthcare Facility	The material presented in this chapter applies to all hospitals.
Recommendations for Healthcare Setting	<p>Poor design and organization have both direct and indirect implications on health. The effective and timely delivery and receipt of care may be directly impacted, while stress may be indirectly affected by the environment. Sources of stress include factors of the environment that contribute to perceived lack of control (ex. light and temperature), lack of privacy, competing role demands, multiple and competing stimuli, noise, and crowding.</p> <p>Hospital design and patient care are influenced by changes in technology associated with diagnosis and treatment. Equipment is expensive and requires larger spaces. Hospital design is also influenced by medical regulations and construction and design codes.</p> <p>The use of light, materials, and color to liven up the patient environment is a recent trend.</p> <p>The pattern of design of the nursing unit may influence the nurses' satisfaction and delivery of healthcare.</p>
Implications of Findings	Hospital design should attempt to minimize stressors that can influence patient care. No mention was made in regards to room occupancy.

Solovy, A. (2002, December). "Home" Improvement. *H&HN: Hospitals and Health Networks*, 76(12), 28.

Focus of Article	To describe the change in design of hospital rooms.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	Driven by consumerism and increased involvement of family members in the treatment of patients, larger private rooms with greater space for family members have been designed. Rooms now include foldout beds, desks, Internet access, and greater control of lighting. Privacy is also increased and patients can confer with their doctors and family members.
Implications of Findings	A trend towards large private rooms exists to accommodate family members and to increase privacy.

Spear, M. (1997). Current issues: Designing the universal patient care room. *Journal of Healthcare Design*, 9, 81-83.

Focus of Article	To describe how the universal patient care room should be designed.
Type of Healthcare Facility	The recommendations suggested have been applied to Massachusetts General Hospital in Boston.
Recommendations for Healthcare Setting	<p>Spear suggests that the problem with current patient rooms is that they have not been designed for any active functioning. Most patient rooms do not acknowledge family participation. There are also too many double occupancy rooms which often do not comply with ADA standards. Beds cannot be moved out of the room, medical equipment does not fit in the rooms, and patients fall because the room is cluttered. The universal patient room is designed for single occupancy. The goal of this room is to support the clinical functions of a patient and the hospital should have the ability to place any patient in any room. Family, friends, and others are included in the care of the patient. The universal design anticipates changes in practice patterns, enables more bedside care, and includes smarter building infrastructure.</p> <p>There are four functional processes that go into the patient's room: activities of daily living, communication among staff, visitors, families, patients and students, interactions with the environment, and therapies and diagnostic services.</p>
Implications of Findings	To ensure optimal patient care, patient rooms should be single occupancy.

Stichler, J. F. (2001). Creating healing environments in critical care units. *Critical Care Nursing Quarterly*, 24(3), 1-20.

Focus of Article	To describe how the critical care unit can be designed to enhance the healing process of patients.
Type of Healthcare Facility	The material presented in this article applies to the Critical Care Units of hospitals in the United States.
Recommendations for Healthcare Setting	<p>Patients experience a positive outcome in environment that incorporates natural light, elements of nature, soothing colors and pleasant sounds. Healing environments improve one's connection with nature, culture, and people, and promote a positive awareness of one's self.</p> <p>A trend exists toward the use of universal rooms. These rooms are larger and can accommodate patients and family members as well as provide increased storage for equipment. Bathrooms should be placed in each patient room or between every two patient rooms to increase flexibility and adaptability of the unit. Visibility into and out of the patient room is also critical and patients should have a view from an outside window. A balance must be achieved between the need for staff to view patients and respect for the patients' privacy.</p> <p>Natural light should be included in the rooms, and patients and their visitors should control the intensity of lighting. Colors should be soothing, and artwork should focus on nature scenes that are serene. Furnishings used in the rooms and on the ward should be comfortable and durable. Noise reduction strategies should be in place and patients should have their need for privacy respected.</p> <p>In terms of nursing units, the optimal design would include a mini-station between every two patient rooms, which includes computers, telephones, and visibility into the patients' rooms. A central nursing unit should be placed within the unit to maximize visibility into all the patient rooms.</p> <p>The family room should be located adjacent to the critical care unit and should be large enough to accommodate family members. Staff lounges should be comfortable and should be located nearby so that staff can return to the unit quickly should an emergency arise.</p>

The optimal design of the patient unit is in multiples of four beds to provide easy access to the patients and to promote visualization of patients.

The circular design of a unit allows for the centralization of care functions and provides immediate access to the patient. Disadvantages of this unit are that it is noisy, storage space is small, and it appears cluttered.

The triangular design reduces travel distance from the nursing station to the patients' rooms, it provides for a maximum number of rooms to be located on one floor, it allows for the design of multiple nursing stations, and centralizes space for supplies and equipment. Disadvantages of this design are that visibility of patients in remote corners is minimized and expansion of this unit is difficult.

Clustered designs facilitate the visualization of nurses of their patients, enable more patient rooms to be located on the peripheries of the building, and allow for the design of mini-nursing stations. The disadvantages of this design are the decentralization of care and the social needs of nurses not being met.

The rectilinear design is less costly to build, contains a centralized location for supplies and equipment, and improves way-finding for visitors. The disadvantages of this design are increased distance traveled by nurses, diminished visualization of patients in remote rooms, and increased space required for patient rooms.

Implications of Findings

Patient rooms incorporate the universal design, which facilitates patient comfort. The environment should be designed to promote healing. Various ward designs can be used, and each has its own advantages and disadvantages.

Thompson, J. D. & Goldin, G. (1975). Supervision/observability: A review of contemporary British literature on privacy versus supervision. In J. D. Thompson & G. Goldin (Eds.), *The hospital: A social and architectural history* (pp. 231-250). London: Yale University Press.

Focus of Article	To discuss the design of wards in British hospitals.
Type of Healthcare Facility	The material presented in this chapter applies to hospitals in Britain.
Recommendations for Healthcare Setting	<p>Hospitals in Britain place an emphasis on supervision and economy rather than privacy of patients. The Nightingale ward design was prominent in hospitals from 1861 to the beginning of World War II. This design included two rows of beds in an open ward design. Two bathrooms were available for every 25-30 beds. Private rooms were not highly regarded by Florence Nightingale as she felt they interfered with a nurse's ability to supervise patients.</p> <p>Important for nurses was their ability to supervise patients, to respond to them quickly in the event of an emergency, and to reach a patient in the shortest amount of time possible.</p> <p>Private rooms, which became more evident after the war, were used mainly for extremely ill or dying patients and for those who had infectious diseases.</p> <p>Nuffield studies determined that a trained nurse could handle approximately 8 patients during peak hours and about twice the amount during non-peak hours. Wards were configured in multiples of 8, with an average number of beds being 32. Various ward designs were used such as the racetrack design and the single-corridor design. Multiple-occupancy rooms formed the majority of the rooms, though single-occupancy rooms were available for the infectious patients. Lighting and artificial ventilation affected how hospitals were designed. Rooms with six beds often did not have the proper lighting for doctors to examine patients, and wards required the use of artificial ventilation to reduce the risk of spreading infections. Privacy is an issue, and there are some supporters of the single-occupancy rooms since they offer patients the greatest amount of privacy.</p>
Implications of Findings	Hospitals in Britain tend to favor the use of multiple-occupancy rooms to facilitate supervision of patients, though there are some proponents of single-occupancy rooms.

Thompson, J. D. & Goldin, G. (1975). A loud, loud noise about privacy: A review of contemporary American literature on the hospital room. In J. D. Thompson & G. Goldin (Eds.), *The hospital: A social and architectural history* (pp. 207-225). London: Yale University Press.

Focus of Article To discuss the issue of privacy in hospitals in relation to room occupancy.

Type of Healthcare Facility This chapter applies to all hospitals, though an emphasis is placed on hospitals in the United States.

Recommendations for Healthcare Setting

One's preference for single occupancy rooms is affected by one's social class. Specifically, those of lower classes prefer shared-occupancy rooms.

In terms of design, the Victorian hospitals were influenced by Florence Nightingale, whose preference was towards open wards that facilitated the supervision of patients by their nurses. Hospitals adapted the Nightingale wards and provided for a small number of private rooms for patients requiring isolation. Private rooms were also provided to patients who desired them for social reasons and were willing to pay a fee for the rooms.

Asa S. Bacon encouraged the use of private rooms. He felt that the hospital was more efficient if it consisted of private rooms since these rooms offered more flexibility. Bed occupancy would no longer be an issue as patients could be placed in any of the rooms and the rate of infection could be reduced. Better examinations of patients could be conducted as well, visiting rules could be less stringent, and room temperatures could be adjusted to suit the individual patient's needs.

L. J. Frank also supported the use of private rooms as he felt the patient could relax and would not be disturbed to the same extent as in a shared occupancy room. He felt the issue of the amount of traveling by nurses could be reduced through the inclusion of a utility room between every two rooms.

World War II helped support the provision for private rooms as it was discovered that patients recovered faster when they had their own private toilet.

From an economical point of view, multiple-occupancy rooms are more efficient as more patients can be placed along one corridor. This also facilitates the nurses' supervision of their patients as their traveling time is decreased. The most

economical configuration is a six-bed room with three beds on each side of the room.

The double-corridor design reduces the amount of walking the nurse will incur. This design became popular with the advent of air conditioning.

In designing the patient room, planners take into account various factors. These include reducing the amount of travel done by nurses through the inclusion of necessary utilities in the room, subdividing multiple-occupancy rooms into cubicles, changing the placement of the bed to reduce the width of the room, and designing a smaller room altogether. Patient room design includes circular, square, and hexagonal shapes.

Implications of Findings

Private rooms are preferred by those of upper social classes, whereas those of lower social classes prefer multiple-occupancy rooms.

Tidwell, C., & Sowman, J. (2002). The healing space. *Managed Healthcare Executive* 12(5), 35-36

Focus of Article	To demonstrate how effective healing environments produce quantifiable effects on the patient's experience. This includes, but is not limited to, a reduction in pain medications, enhanced patient satisfaction, shortened lengths of stay, and decreased operational expenses
Type of Healthcare Facility	The facilities described in the article are the Florida Hospital Heartland Medical Center and the Woman's Health Center in Bellmore, New York.
Recommendations for Healthcare Setting	<p>The Florida Hospital Heartland Medical Center is a three-story facility. It features a reception rotunda, which includes an information center as well as a gift shop. Elevator access as well as central stairs are located within a central corridor and are clearly visible. The second and third floors include the inpatient rooms and services. The nurses' stations are dispersed so that one nurse can simultaneously view four patients. The patient rooms are private and are painted in neutral colors. Lighting is both natural and artificial. Restrooms are located on an exterior wall of the inpatient rooms, enabling the staff to view and respond to the patient if necessary. Other wings include a health club, physician's lounge, emergency entrance, clinical pharmacy and labs, as well as physicians' offices. A courtyard with a reflecting pool is also visible.</p> <p>The Woman's Health Center integrates ideas and images related to garden, greenhouse, and lantern. It includes a medical suite, an imaging suite, and a healthy living suite. Soothing colors, warm textures and natural materials are used throughout the building. The quality of light is enhanced through the use of skylights.</p>
Implications of Findings	Private rooms are preferred in the design of the Florida Hospital Heartland Medical Center, although reasons were not provided for this preference. Care is delivered with greater efficiency and wellness and good health are promoted in the Woman's Health Center. No mention is made in terms of preference for single or multiple room occupancy at the Woman's Health Center.

Tradewell, G. B. (1993). Contemporary nursing unit configuration. In D. K. Hamilton (Ed.) *Unit 2000: Patient beds for the future. A nursing unit design symposium* (pp. 191-215). Houston: Watkins Carter Hamilton Architects, Inc.

Focus of Article	To describe the design of patient care units.
Type of Healthcare Facility	The material presented in this chapter applies to all hospitals.
Recommendations for Healthcare Setting	<p>The Nightingale ward is a basic open ward design. Nurses are located among patients and the support stations are located outside the ward. This type of ward contains approximately 30 to 32 beds and visibility of all patients was the goal of this design.</p> <p>The Continental, or single- and double-corridor design contains patient rooms along one or both sides of the corridor. Instead of an open ward, rooms contain 4 to 6 beds. The unit also contains a central nursing station and support space supplies the unit.</p> <p>In the Racetrack design, patient rooms are located further apart and support spaces are located between two corridors. Nurses do not favor this design because travel distances are high, visualization of the corridors is poor, one nursing station supports a large number of patients, and only one clean and one soiled utility room is provided.</p> <p>The cluster design encompasses patient rooms around nursing substations. One nursing station is dedicated as the central nursing station.</p> <p>Travel distances are fairly short in the triangular design. The criteria that must be met to create a good design include the organization of patient rooms, observation of patients, number of nursing stations needed, distribution of support space, flexibility, and travel distances.</p>
Implications of Findings	Ward design must encompass factors such as the organization of patient rooms and the number of nursing stations needed. Room occupancy varies among the designs, and preferences were not specified.

Ulrich, R. S. (1997). Pre-Symposium Workshop: A theory of supportive design for healthcare facilities. *Journal of Healthcare Design*, 9, 3-7.

Focus of Article	To describe factors of hospital design that contribute to positive outcomes for patients.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>Hospital design is increasingly taking into account the environmental qualities and strategies that can have a positive effect on patient outcomes. Design that does not enable patients to cope with stress can have a negative effect on their health outcomes. Stress can manifest itself in problems with sleeping, outbursts of anger, and noncompliance with medication. Noisy and visually unstimulating environments undermine a patient's sense of control and autonomy. Design that helps patients cope with stress includes a sense of control with respect to physical surroundings, access to social support, and access to positive distractions.</p> <p>Approaches for increasing the patient's sense of control include bedside dimmers, headphones to listen to music, and attractive grounds.</p> <p>Social support can be fostered through the inclusion of a sleeper sofa in patient rooms, comfortable waiting areas, and sitting areas.</p> <p>Positive distractions include nature (gardens, trees, water, plants...), music, television, aquariums, and window views. Positive outcomes that a patient can achieve through supportive design are reduced stress and anxiety, reduced pain, improved satisfaction, and improved alertness. Hospitals can also experience lower costs as length of patient stay may be reduced.</p>
Implications of Findings	Patients can experience positive health outcomes through supportive designs. No mention was made in regards to room occupancy.

Verderber, S. & Fine, D. J. (2000). Reinventing the patient room. In S. Verderber & D. Fine, *Healthcare architecture in an era of radical transformation* (pp. 195-222). New Haven, CT: Yale University Press.

Focus of Article	To describe the design of patient care units.
Type of Healthcare Facility	The material presented in this chapter applies to hospitals in the United States and Europe.
Recommendations for Healthcare Setting	<p>Hospital design has shifted from traditional open wards to the use of private rooms. Single-occupancy rooms were deemed by the U.S. General Accounting office to be the most cost-efficient in terms of day-to-day operations and initial construction costs. Nightingale hospitals were deemed inefficient due to the excess vertical movement between floors, the difficulty of expansion, and the basic changes in overall service mix of hospitals.</p> <p>The cluster unit minimized the distances traveled by nurses and enabled nurses to deliver a higher-level of care than the traditional linear unit.</p> <p>The use of high-tech equipment and furnishings affected room design in terms of bed positioning, ceiling height, closets, overall size of the rooms, and window positioning. The Planetree movement incorporated the participation of the patients and their family members. An emphasis was placed on education, personalization, and the demystification of the illness. Planetree determined that patients were denied supportive human relationships, physical comfort, and independence in the hospital environment.</p> <p>Transformational rooms can be converted and reverted to their initial stage. These rooms can be altered to possess various functions. Bedside computers enable nurses to input patient data immediately and give patients access to their medical information. Private patient rooms are made larger to accommodate equipment, such as the bedside computers, as well as family members.</p>
Implications of Findings	Patient rooms have evolved from open wards to private rooms that are large enough to accommodate equipment and family members.

Voelker, R. (1994). New trends aimed at healing by design. *Journal of the American Medical Association*, 272(24), 1885-1886.

Focus of Article	To describe the use of the Planetree philosophy in hospitals.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	The Planetree philosophy blends efficient surroundings and emotional support with medical care. In terms of design, soft lighting is used as well as carpeting to absorb noise. Soothing colors and artwork help to make the environment more like home. Patients are also given control of their surroundings. This includes lighting, temperature, and the television. Patients should be allowed to bring personal possessions to the hospital. Air quality should also be good. Nurses' stations are designed to encourage communication. Incorporated in the design are windows that give the patients an external view.
Implications of Findings	The Planetree philosophy focuses on patient-centered care. No mention is made in regards to room occupancy, though it appears that this philosophy is geared towards a private room which incorporates space for caregivers.

Watkins-Miller, E. (1998, February). Design cures. *Buildings (Supplement – Building Interiors)*, 10-14.

Focus of Article	To describe the features of the Marburg Pavilion at John Hopkins Hospital in Baltimore.
Type of Healthcare Facility	The material described in this article applies to the Marburg Pavilion at John Hopkins Hospital in Baltimore.
Recommendations for Healthcare Setting	The facility incorporates elegant furnishings and hotel-like amenities. The cost for a private patient room is \$800 per day and the rooms include, for instance, hardwood floors, and a cherry wood cabinet that holds a television, fax machine, a safe, and the patient's clothing. Warm colors and lighting were used to make the setting comfortable for the patient. Lighting is brighter in certain areas and dimmer in other areas. Artwork and patterns are used and can serve as wayfinding devices.
Implications of Findings	Private rooms with elegant features are used to make the stay more pleasant for the patient

Weber, D. O. (1995, March-April). Environments that heal. *The Healthcare Forum Journal*, 38(2), 42.

Focus of Article	The focus of this article is to describe features of hospitals that promote a therapeutic environment.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>Hospitals should be designed to encompass the spiritual, mental, and emotional dimensions of patients. The Planetree philosophy integrates seven patient-centered values into healing: patient participation, autonomous decision-making, choice, involvement of family and friends, access to information, respect for the individual, and the provision of supportive human and physical environments. Emphasis is placed on factors such as a good medical reference library, eliminating barriers between caregivers and patients, and urging patients to read and annotate their own medical charts. Air quality should be good and hospitals have been experimenting with natural fragrances to improve the quality and to promote healing.</p> <p>Excess noise should be eliminated. This can be accomplished through source attenuation and source elimination. Natural sound and music can be used to contribute to a positive environment for the patient.</p> <p>Lighting should be effective and patients should have windows to view daylight.</p>
Implications of Findings	Hospitals should be designed to promote a therapeutic environment. No mention was made in regards to room occupancy.

Weisman, E. (1994, November 25). Built-in care. *Health Facilities Management*, 24-33.

Focus of Article	To describe the design of Griffin Hospital.
Type of Healthcare Facility	The information presented in this article applies to Griffin Hospital in Derby, Connecticut.
Recommendations for Healthcare Setting	The design of this hospital is based on the Planetree philosophy, which is based on patient-centered care. Rooms in this facility are semi-private and are designed in an L-shape to give the patients a degree of separation from each other as well as a sense of their own space. The bathroom is located in the center of the room. There are three 23-bed units, and each includes two swing beds available to family members. Each unit also consists of several satellite nursing stations located in corridors that branch off the main corridor. These stations are surrounded by a cluster of three to four patient rooms and shield patients from those walking down the main corridor.
Implications of Findings	This facility consists of semi-private rooms designed in an L-shape. This design helps to give patients a sense of control while simultaneously offering a degree of separation between patients.

Withecumbe, P. (1997). Focusing on innovation. *Hospital Development*, 28(3), 18-19.

Focus of Article	To describe how the Echelon and Focus methods of ward planning promote efficiency and patient comfort. The Echelon ward design incorporates the Nightingale multi-bed dormitory design and enhances amenity and privacy for the patients combined with the ability of the nursing staff to easily observe patients. It is a cost-efficient design. The Focus design incorporates and expands the Echelon design.
Type of Healthcare Facility	The Echelon design was developed by Estatecare for community hospitals in Wales. Mold Community Hospital is the focus of the article. The Focus design was used in the Princess of Wales DGH Bridgend hospital.
Recommendations for Healthcare Setting	The Echelon design suggests the use of a 20-bed ward. The nurse's base should be located centrally with a direct view into each 8-bed bay. An "L" shaped corridor is used to give the perception of a shorter corridor. The bed heads should be staggered with each bed located in a corner area within the bay. Each bed head is visible from the nurse's base and each patient can see the nurse's base as well. The bed area should have its own ambience with interior finishes and light fixtures, which illuminate each bed area. Storage provisions, including a bedside locker and storage alcove on a sidewall are planned as well as a pin-board behind the alcove. The Focus design includes a two 23-bed acute ward template. It incorporates the Echelon bays, which are clustered around a central nurse base. Patient rooms are only a short distance away, facilitating observation. The focus design is compatible with a Nucleus hospital design and is cost-efficient.
Implications of Findings	While both designs incorporate multiple beds in the rooms, each design offers increased privacy for the patient while promoting cost-efficiency.

Williams, M. (2001, November). Critical care unit design: A nursing perspective. *Critical Care Nursing Quarterly*, 24(3), 35-42.

Focus of Article	To describe the design of a critical care unit based on the premise of offering more efficient care as well as a comfortable environment for patients.
Type of Healthcare Facility	The material presented in this article applies to the Critical Care Units of hospitals in the United States.
Recommendations for Healthcare Setting	<p>The goals of the critical care unit should be to provide efficient care for patients and to promote a healing environment for both patients and their family members. From the nursing stations, nurses should have both direct and indirect visualizations of patients. Supply areas should be accessible from patient areas to make efficient use of the nurses' time. There should also be multiple entrances to the critical care area: one for visitors and health care providers and one for patient transport and transfer.</p> <p>Patient rooms need outside windows and direct visualization from the nurses' station. Patient rooms may be divided into three areas: a patient area, a family area, and a caregiver area. The patient area consists of a bed, bedside table, and a bedside chair. The family area should include storage space as well as somewhere to sleep. The caregiver area includes supplies and equipment.</p> <p>Temperature controls should be in all rooms and adjusted for the patients' needs. A board can also be in the room and used by the patient to display personal belongings. Artwork, including nature scenes, are comforting for patients and their families. The family waiting area needs to be large enough to accommodate visitors.</p>
Implications of Findings	The rooms in the critical care units should be visible from the nurses' stations and should be large enough to accommodate patients and their family members. Room occupancy was not mentioned, though the implication was that rooms were single-occupancy.

Williams, M.A. (1988). The physical environment and patient care. *Annual Review of Nursing Research*, 6, 61-84.

Focus of Article	To review literature linking physical environment factors to patient care.
Type of Healthcare Facility	The material presented in this article pertains to studies conducted in the United States and the United Kingdom.
Recommendations for Healthcare Setting	<p>Nursing behaviors that are affected by unit design are ease and frequency of interaction with patients and families, travel time, staffing requirements, infection control, satisfaction, surveillance, and communication. Effective and efficient nursing care was related to short travel distances traveled by nurses and features that maximize communication between nurses and patients. The social organization of the hospital was discovered to define the relationship between space use and staff roles. Infants were found to be particularly vulnerable to continual loud noises. Average levels of sound in patient rooms were found to exceed recommended levels on a surgical nursing unit. Color is thought to elicit certain psychophysiological reactions in humans.</p> <p>Two main functions of the physical environment are a symbolic role and the facilitation of the therapeutic process.</p>
Implications of Findings	The physical environment can impact patients in a variety of ways. No mention was made in regards to room occupancy.

Empirical Articles: Disease Control and Falls Prevention

Anderson, J. D., Bonner, M., Scheifele, D. W., & Schneider, B. C. (1985). Lack of nosocomial spread of varicella in a pediatric hospital with negative pressure ventilated patient rooms. *Hospital Infection*, 6(3), 120-121.

Focus of Study	To compare hospital rooms in a new hospital that are equipped with negative pressure ventilation to rooms in an old hospital without this ventilation system in terms of prevention of nosocomial infections.
Research Design	<p>Patients with Varicella zoster were transferred from other wards to the Isolation Unit. They were admitted to a room with single occupancy and nurses used strict isolation techniques.</p> <p>Index cases were considered infectious from one day before the appearance of the rash until scabbing was complete. Susceptible persons were identified as patients who were on the ward at the same time as the infectious patient and who had not been previously exposed to chickenpox during the previous 21 days. They also had no previous history of chickenpox.</p>
Sample Information & Site	The study was conducted on the Isolation Unit of British Columbia's Children's Hospital. The sample included 5 index cases and 125 susceptible cases.
Findings	No secondary spread of the infection was found in the susceptible patients in the new hospital with negative pressure ventilation. In 1979, in the Isolation Unit of the old hospital, 7 chickenpox infections were detected among 41 susceptible patients from 2 index cases.
Implications of Findings	Negative pressure ventilation appears to be beneficial in preventing the spread of chicken pox on an isolation unit. Rooms in this study were single occupancy as it was an Isolation Unit and patients were susceptible to acquiring infections from other patients.

Groves, J. E., Lavori, P. W., & Rosenbaum, J. F. (1993, Winter). Accidental injuries of hospitalized patients. A prospective cohort study. *International Journal of Technology Assessment in Health Care*, 9(1), 139-144.

Focus of Study	To study the frequency and types of incident reports filed for patients by nursing staff.
Research Design	Incident reports were retrieved for patients from the files of the legal department in the hospital. To record the incidents, the 'Report of Incident or Unusual Occurrence' form was used. Details on this form include items such as the patients' names, the incident location and time, the person who discovered the incident, condition at discovery, and nature of injury.
Sample Information & Site	The study was conducted over a three-month period at a 1,082-bed tertiary-care hospital. The sample included 806 patients who were admitted through the emergency ward.
Findings	<p>Of the subjects included in the study, 107 patients experienced a total of 161 incidents. Of these, 93 incidents were considered hazardous, or nonmedication errors. 18 patients suffered minor injuries. Hazardous incidents were more common among males between the ages of 20 and 40 and medically ill females over the age of 60.</p> <p>Limitations of this study include a sample drawn from admissions from the emergency ward. The sample may have been skewed toward the more seriously ill patients. Another limitation is the assumption of the hospital as a single environment. Different wards may have different risks of accidents as the nature and severity of illnesses varies among the wards.</p>
Implications of Findings	The majority of incidents that occurred were not due to medication errors. Rather, they were due to falls and other incidents. No mention was made in regards to room occupancy.

Hendrich, A., Nyhuis, A., Kippenbrock, T., & Soja, M. E. (1995, August). Hospital falls: Development of a predictive model for clinical practice. *Applied Nursing Research*, 8(3), 129-139.

Focus of Study	To develop a risk model that may be used to assess and identify different levels of risk of falls in acute care populations. This study also attempts to identify key areas for nursing interventions and fall-prevention programs.
Research Design	A retrospective chart review was completed using an epidemiological approach. Falls were assessed using incident reports from the hospital during a one-month period. Risk factors were measured based on the information in the patient's record, in particular, the nursing assessments. Patients' charts were reviewed for risk factors present at admission and within 24 hours preceding the fall.
Sample Information & Site	The study took place at a 1,120 Midwest teaching institution. The sample included 102 fall charts and 236 non-fall charts, as the researchers wanted a ratio of approximately two non-fall subjects for each fall subject. The subjects were randomly selected.
Findings	<p>Most falls occurred in the patients' rooms while they were alone and attempting to get to the bathroom. No significant differences were found between the nursing shifts, and physician activity orders were not always reflective of the patients' risk levels.</p> <p>Nursing interventions are based on increased patient observation, the environment, assistance with and promotion of mobility, patient reorientation, and bladder training. Patients are classified on their degree of risk during a nursing shift.</p>
Implications of Findings	Programs should be developed that take into consideration risk factors of patients in regards to their falls. No mention was made in terms of room occupancy, though the majority of falls occurred while the patient was alone in his or her room.

Jones, W. J., Simpson, J. A., & Pieroni, R. E. (1991, Summer). Preventing falls in hospitals. *Hospital Topics*, 69(3), 30-33.

Focus of Study	To examine the role of patient age and diagnostic status in predicting patient falls.
Research Design	Incident reports were collected from the facilities, as was information pertaining to the patients' age and diagnostic status. Control groups consisting of non-incident patients were set up at both facilities.
Sample Information & Site	The study took place at a large urban medical center and a small psychiatric facility in Memphis, Tennessee. Subjects included 234 patients who reported incidents and 185 control patients at the large urban medical center. 96 patients who reported incidents and 100 control patients were used from the psychiatric facility.
Findings	<p>At the medical center, a sharp rise in falls was noted for patients over the age of sixty. Patients at this facility diagnosed with circulatory system problems were more likely to fall.</p> <p>At the psychiatric facility, 36% of falls occurred in patients 19 years of age and younger, and 30% of falls occurred to patients over the age of sixty. This may be due to the fact that most adolescents in the facility were being treated for substance dependence problems. This problem was second only to affective disorders in predicting patient falls.</p>
Implications of Findings	Age and diagnostic status were significant predictors of incident status. No mention was made in regards to room occupancy.

Langner, D. (1996, September). Accident analysis in a busy surgical ward. *Curationis*, 19(3), 52-53.

Focus of Study	To analyze factors that are associated with falls on a busy surgical and urological unit.
Research Design	Forms were filled out which included information on cot-sides in situ/refusal, occupancy status, number of staff on duty, and whether a bell was at hand. The analysis of the falls comprised of time of day, age group, location of accident, cot-side influence, patient activity, and type of injuries.
Sample Information & Site	The study took place on a busy surgical and urological unit in a private hospital in Durban. This hospital consists of 4 general wards, 5 semi-private wards and 5 private wards. The sample included 22 patients who experienced falls during the time of this study.
Findings	The majority of accidents occurred during the morning, between 8 and 10 am. During the night, most accidents occurred between midnight and 4 am, when staff coverage is low. Most accidents took place while the patient was on his or her way to the bathroom. Accidents were most frequent among patients between 70 and 80 years of age. The type of ward did not influence the occurrence of an accident. Those without cot-sides were more likely to experience a fall. Of the patients who fell, 45% suffered an injury.
Implications of Findings	Accidents were most likely to occur in the morning, among the elderly, and those on their way to the bathroom. Ward design did not impact the incidence of falls.

Levene, S., & Bonfield G. (1991, September). Accidents on hospital wards. *Archives of Disease in Childhood*, 66(9),1047-1049.

Focus of Study	To investigate accidents occurring to children on pediatric units. Information was gathered in regards to factors associated with accidents and measures were proposed to reduce the frequency and severity of accidents.
Research Design	Questionnaires were distributed over an initial pilot period lasting three months and then over the course of one year. Information collected consisted of details regarding the accident including the injured person and the injury sustained and the supervision of the child.
Sample Information & Site	The convenience sample included eight hospitals with pediatric wards. These hospitals varied from specialized pediatric hospitals to district hospitals. Subjects included inpatients, outpatients, or visitors to these hospitals sixteen years of age or younger. A total of 781 questionnaires were collected and analyzed.
Findings	<p>Accidents were most frequent amongst boys of all ages and children under the age of five. Of the accidents that occurred, falls from a height were the most common followed by being struck by or coming into contact with equipment, and being scalded by a hot drink. One child was trapped between the cot bars and the mattress.</p> <p>The most common result of an accident is no injury. Of injuries that did occur, bruises and lacerations were most frequent. The head was the site most injured.</p> <p>Of the 732 accidents that occurred, forty-one percent occurred while the child was in the presence of his or her parents, and twenty-seven percent of accidents involved beds and cots.</p> <p>Several of these injuries could have been prevented with educating parents as to how the cot sides should be used. The hospital should also take into account the height of the bed as it is probably higher than the beds children have at home.</p>
Implications of Findings	Although the majority of accidents did not result in an injury, several of these accidents could have been prevented with the proper use of equipment. No mention was made in regards to room occupancy.

Mulin, B., Rouget, C., Clement, C., Bailly, P., Julliot, M., Viel, J. F. et al. (1997). Association of private isolation rooms with ventilator-associated *Acinetobacter baumannii* pneumonia in a surgical intensive-care unit. *Infection Control and Hospital Epidemiology*, 18(7), 499-503.

Focus of Study	To assess the rate and routes of <i>Acinetobacter baumannii</i> colonization and pneumonia among patients who were mechanically ventilated in a surgical intensive-care unit.
Research Design	Specimens from patients were screened for the presence of <i>Acinetobacter baumannii</i> over a six-month period prior to and after renovations were completed on the unit. The old unit included seven isolation rooms and two open rooms with four beds each. The new unit included fifteen isolation rooms and each room had a hand-washing sink.
Sample Information & Site	The study took place on the surgical intensive-care unit at University Hospital of Besancon, France. The subjects included 135 patients prior to the renovations and 179 patients after the renovations were complete.
Findings	Of the patients who had infected bronchopulmonary tracts, twenty-nine of the patients were infected prior to the renovations, while only two were infected after the renovations. Colonization rates were greater prior to the renovations (28.1% prior to the renovations versus 5% after the renovations), and were associated with prolonged stay in hospital. Cross-transmission was the major route of colonization.
Implications of Findings	The move from open to isolation rooms may help control the bronchopulmonary tract acquisition of <i>Acinetobacter baumannii</i> in mechanically ventilated patients.

Pullen, R., Heikaus, C., & Fusgen, I. (1999, December). Falls of geriatric patients at the hospital. *Journal of the American Geriatrics Society*, 47(12),1481.

Focus of Study	To identify risk factors that contribute to patient falls in a geriatric facility.
Research Design	Falls were recorded prospectively during a one-year period. Formal check lists were used by the nurse or therapist assigned to the patient to document the circumstances regarding the fall.
Sample Information & Site	The study included all patients at a geriatric hospital during a one-year period (January 1, 1997-December 31, 1997). The majority of the rooms in this facility consist of two, three, or four beds. Only four rooms are single occupancy.
Findings	During the time frame of this study, 536 falls occurred on the five hospital wards. Most falls (444) occurred in the patients' hospital rooms when they were alone or with other patients. Seventy-four falls occurred when the patients were alone in the bathroom.
Implications of Findings	Improved monitoring is needed to prevent patient falls. Most falls occurred in the patients' rooms, though it was not specified if there was a relationship in regards to the falls that occurred and how many people were in the room.

Seltzer, E., Schulman, K. A., Brennan, P. J., & Lynn, L. A. (1993, December). Patient attitudes toward rooming with persons with HIV infection. *Journal of Family Practice*, 37(6), 564-568.

Focus of Study	To examine patient attitudes in regards to rooming with patients with HIV infection and other medical conditions.
Research Design	Surveys were administered to patients to examine their preference for single or double occupancy rooms, to assess their knowledge of HIV, and to inquire about their attitudes regarding rooming with a patient who had HIV, cancer, pneumonia, dementia, or disfiguring skin lesions. Surveys followed the structured-interviewer format.
Sample Information & Site	The study took place at a University hospital in an inner city. The sample included 104 inpatients.
Findings	<p>Of the patients surveyed, 55% stated that they would not room with an HIV-positive patient. Of these patients, 46% preferred a private room while in the hospital, whereas 24% of those who did not object preferred a private room. Those that objected tended to have a roommate with other medical disorders.</p> <p>A significant number of those that objected to rooming with a person with HIV felt they had the right to know the reason why their roommate was hospitalized. These patients also had a poorer knowledge in regards to the transmission of HIV. There were no differences between those that did and did not object to rooming with an HIV-positive patient in regards to their perceptions of their knowledge of HIV. None of the patients knew the hospital's policy in isolating HIV-positive patients, and none requested this information.</p>
Implications of Findings	Lack of knowledge regarding HIV infection may be an underlying cause to people's fear of rooming with HIV-positive patients. The majority of patients preferred a private room instead of sharing a room with an HIV-positive patient.

Shirani, K.Z., McManus, A.T., Vaughn, G.M., McManus, W. F., Pruitt, B. A. Jr. & Mason, A. D. (1986). Effects of environment on infection in burn patients. *Archives of Surgery*, 121, 31-36.

Focus of Study	To investigate the effect of using isolation measures on the infection and mortality rates of burn victims.
Research Design	Two wards were used for this study. The first ward was open in design and facilities for hand washing were limited. The second ward was renovated to include individual rooms, most of which were single-occupancy. Each room contained a sink. Patients on each ward were observed for a year, and each patient was assessed daily through physical examinations and laboratory tests, when needed. Observed and predicted mortality were determined.
Sample Information & Site	The study took place on two wards, one of which was open, and the other which contained individual wards. 173 patients were observed on the open ward, while 213 patients were observed on the renovated ward.
Findings	On the renovated ward, the observed mortality was significantly lower than the predicted mortality for patients who did not acquire an infection. Infections that were reduced on the renovated ward were bacteremia and urinary tract infections. The prevention of infection was the primary reason that survival rates increased on the renovated ward.
Implications of Findings	The incidences of nosocomial infections and mortality were decreased through changes in the patient environment. Having an individual room with its own hand washing facility appears to decrease the risk of infection for burn patients.

Stelfox, H. T., Bates, D. W., & Redelmeier, D. A. (2003, October 8). Safety of patients isolated for infection control. *Journal of the American Medical Association*, 290(14), 1899-1905.

Focus of Study	To examine the quality of care received by patients who are in isolation due to infection control.
Research Design	Consecutive adults admitted to both hospitals who were isolated for at least two days were identified as subjects. For each isolated patient, two matched controls were identified. Patient charts were reviewed for hospital, demographic, and clinical data. Process of care measures included documentation of patient vital signs and clinicians' narrative notes. Injuries caused by medical management were used to define the occurrence of an adverse event. These included injuries that prolonged the patients' stay or produced disability and injuries that resulted in transient disability or abnormal laboratory value measurements. Patient satisfaction was also measured through reviews of medical records and unsolicited complaints.
Sample Information & Site	The study took place at 2 North American hospitals. The first was Sunnybrook and Women's College Health Sciences Centre in Toronto, Ontario, and the second location was Brigham and Women's Hospital in Boston, Massachusetts. Patients from Sunnybrook comprised of a general cohort of patients who had various diagnoses. Patients from Brigham comprised of a disease-specific cohort; these patients were admitted with a diagnosis of congestive heart failure. The general cohort consisted of 78 isolated patients and 156 control patients while the disease specific cohort included 72 isolated patients and 144 control patients.
Findings	<p>Isolated patients were more likely to have incomplete recordings of their vital signs and to have days where their vital signs were not recorded at all. Patients with congestive heart failure were less likely to have a stress test or angiogram once they were admitted to the ward from the emergency department.</p> <p>Isolated patients were twice as likely as control patients to experience an adverse event during their hospital stay. In particular, isolated patients were eight times more likely to experience supportive care failures such as falls and pressure ulcers. No differences were noted in diagnostic, operative, or</p>

medical procedures, and no adverse drug events were discovered.

Isolated patients expressed greater dissatisfaction with their treatment and had longer hospital stays than control patients.

Implications of Findings

Patients in isolation due to infection control are more likely to experience an adverse event during their hospital stay than patients not in isolation.

Sutton, J. C., Standen, P. J., & Wallace, W. A. (1994, March-April). Patient accidents in hospital: Incidence, documentation and significance. *British Journal of Clinical Practice*, 48(2), 63-66.

Focus of Study	To report data on three studies which assess accidents in hospitals.
Research Design	<p>The data reported in this article stems from three interrelated studies. The first, and largest, study was conducted over a one-year period and included all reported patient accidents on ten hospital wards. Data were collected from patient accident reports, patient interviews, nurses' questionnaires, and medical and nursing records.</p> <p>The second study was a comparative study of fifty reported accidents and 50 non-accident patients. The first study was the source of data for this study.</p> <p>The third study used anecdotal evidence from the first two studies. Patients were surveyed on three separate occasions as to whether or not they experienced an accident during their hospital stay. Records were checked to see if an accident report form had been completed.</p>
Sample Information & Site	The study took place on ten wards of a large acute care hospital. The subjects included 515 inpatients on these wards who reported an accident.
Findings	<p>It was discovered that of the inpatients who reported accidents, 382 patients had one accident and 133 had multiple accidents. Patients aged 60 years or older had the most accidents, and the accident rate was greater for males. Those who had an accident were most frequently diagnosed with a neurological disorder. Of those that had an accident, falls were most frequently reported, and one-third of patients were injured as a result of the accident. The majority of accidents were reported by staff to be caused by patient conditions. Nurses also tended to estimate the visual and hearing acuity of patients as higher than the patient thought they were.</p>
Implications of Findings	Falls were the most common type of accidents, and the elderly are most prone to experience an accident. No mention was made in regards to room occupancy.

Tutuarima, J. A., van der Meulen, J. H., de Haan R.J., van Straten, A., & Limburg, M. (1997, February). Risk factors for falls of hospitalized stroke patients. *Stroke*, 28(2), 297-301.

Focus of Study	To assess the incidence of falls as well as identify risk factors for patients hospitalized as a result of a stroke.
Research Design	Trained nonmedical research assistants collected data from the medical and nursing records of patients shortly after they were discharged. The information collected included the type of stroke suffered, stroke severity, medical history, comorbidity, neurological deficits, complications, use of medications, and the intensity of nursing care. When falls occurred, circumstances regarding the fall, such as time of day, place, the patient's activity before the fall and the consequences of the fall, were recorded.
Sample Information & Site	The study was conducted using data from the neurological departments of twenty-three hospitals in the Netherlands. The sample included 720 patients who had suffered from an acute stroke.
Findings	<p>104 of the 720 stroke patients fell at least once. 69 of the patients fell only once, 19 fell twice, and 16 fell three or more times, with a total of 173 falls occurring. Risk factors that increased the likelihood of a fall were heart disease, mental decline, confusional state, and urinary incontinence. Those using major psychotropic drugs were less likely to fall. If patients fell once, their risk of falling a second time was increased.</p> <p>The majority of the falls occurred during the day, in the patients' rooms, and during visits to the bathroom. Approximately 23% of the falls occurred while the patient was in bed or sitting on a chair and approximately 25% of the falls caused injuries, the most serious of which were hip fractures.</p> <p>The number of patients per nurse was unrelated to the number of falls that occurred.</p> <p>Limitations of this study include the use of formal incident reports in hospitals, which may have resulted in underreported incidences of falls. Also, with the use of a large number of hospitals, the quality of data varies because of the different staff and neurologists registering the data.</p>

Implications of Findings

Patients who suffered from a stroke had a relatively high risk for falling. Although a large number of falls occurred in the patients' rooms, room occupancy was not mentioned.

Non Empirical Articles: Disease Control and Falls Prevention

Eickhoff. (2003, August). Active surveillance for the control of VRE: Science or bandwagon? *Infectious Disease News*.

Focus of Article	To discuss recommendations made in the SHEA Guideline for preventing nosocomial transmission of VRE.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>Dr. Eickhoff comments on the “SHEA guideline for Preventing Nosocomial Transmission of Multidrug-Resistant Strains of <i>Staphylococcus aureus</i> and <i>Enterococcus</i>.” In particular, he focuses on the recommendations for VRE, which focus on the development of an institutional program for active surveillance of VRE. Problems with the development of such a program include the sensitivity of the surveillance instrument, which is at approximately 60%. The proportion of hospitals that do not carry out active surveillance for VRE ranges from 60%-70%. Errors in measurement can become ingrained in policy and can damage the academic respectability of hospital epidemiology. Also, due to careful resource management in hospitals, it may not be cost-effective to justify the expenses incurred by active surveillance of VRE.</p>
Implications of Findings	No mention was made in regards to room occupancy.

Kappstein, I. & Daschner F. D. (1991, September). Potential inroads to reducing hospital-acquired staphylococcal infection and its cost. *Journal of Hospital Infection*, 19(Suppl B), 31-34.

Focus of Article	To summarize effective procedures for preventing hospital-acquired staphylococcal infections.
Type of Healthcare Facility	The article review is intended for all hospitals.
Recommendations for Healthcare Setting	<p>Frequent hand-washing is critical in preventing hospital-acquired infections from occurring. Private rooms are only required for patients suffering from staphylococcal pneumonia or skin lesions that cannot be covered by a dressing, as these patients shed a great deal of organisms that can lead to environmental contamination. Those caring for these patients should also wear a mask, and may need impermeable plastic aprons rather than cotton gowns. The design of a hospital is costly and one of the least effective measures in controlling the number of hospital-acquired staphylococcal infections.</p> <p>Patients should have a private room if they suffer from MRSA (methicillin-resistant <i>S. aureus</i>), as MRSA has the potential to be endemic.</p>
Implications of Findings	The most effective measure for preventing staphylococcal infections is frequent hand-washing. Private rooms are necessary in the case of patients suffering from MRSA.

Muto, C. A., Jernigan, J. A., Ostorowsky, B. E., Richet, H. M., Jarvis, W. R., Boyce, J. M., & Farr, B. M. (May, 2003). SHEA guideline for preventing nosocomial transmission of multidrug-resistant strains of *Staphylococcus aureus* and *Enterococcus*. *Infection Control and Epidemiology*, 362-386.

Focus of Article	To present an evidence-based guideline on preventing the transmission of nosocomial infections, in particular MRSA and VRE.
Type of Healthcare Facility	The article review is intended for all hospitals.
Recommendations for Healthcare Setting	<p>Most patients acquire MRSA through external sources, and efforts must be made to control the transmission of this infection. Rigorous infection control practices have been successful in controlling the transmission of MRSA. Some of these practices include stringent barrier precautions, cohort nursing, and isolation of patients.</p> <p>The transmission of VRE can occur via the contaminated hands of healthcare workers or by having the same healthcare worker as an infected patient. Proximity to an unisolated patient is a major risk factor as well. Infection control practices, including isolation, help to reduce the transmission of VRE.</p> <p>Cleaning and disinfecting policies should be developed to control environmental contamination. The pathogens can persist on environmental surfaces for days to months.</p> <p>Infection control programs that emphasize early detection of infected patients help to reduce costs and improve patient outcomes.</p>
Implications of Findings	Infection control programs help to control the transmission of infection in hospitals. Isolation of patients, hand washing, and disinfecting surfaces can help reduce the transmission of infections.

O'Connell, N. H., & Humphreys, H. (2000). Intensive care unit design and environmental factors in the acquisition of infection. *Journal of Hospital Infection*, 45(4), 255-262.

Focus of Article	To describe a design of the intensive care unit to help prevent the spread of hospital-acquired infections.
Type of Healthcare Facility	The article review is intended for all hospitals.
Recommendations for Healthcare Setting	<p>The design of the ICU should minimize the entry and persistence of microorganisms. Cleaning of surfaces, especially those that may have been contaminated, should also be enabled.</p> <p>Pathogens such as <i>Pseudomonas aeruginosa</i> and <i>staphylococcus aureus</i>, as well as infections such as ventilator-associated pneumonia, and wound infections are common in the ICU. The transmission of these and other strains is promoted by poor compliance with hand-washing protocols, shortages of nursing staff, and high density crowding of patients.</p> <p>Single rooms are recommended for patients requiring isolation. A minimum ratio of one cubicle to six bed spaces is recommended, though it may be lower in some cases. The amount of room around the bed should be adequate to separate patients and accommodate equipment. Hand basins should be available for every other bed and they should be equipped with elbow or foot operated faucets. Ventilation is also important, and an air-pressure differential should exist between the patient's room relative to the unit, the filtration of air, and the airflow.</p> <p>Floors should be slip-resistant and easy to clean. Walls should be washable and resistant to the impact of equipment. Countertops should be made of a nonporous solid material and ceiling tiles need to be appropriate for the necessary locations.</p>
Implications of Findings	Handwashing is the most important measure for preventing and controlling the spread of hospital-acquired infections. Private rooms are needed for patients requiring isolation.

Ognibene, F. (2000). Resistant strains, isolation, and infection control. In K. Hamilton (Ed.), *ICU 2010: ICU design for the future*. Houston: Center for Innovation in Health Facilities, 103-111.

Focus of Article	To discuss the requirements that are needed to deal with the risk of an infection in an Intensive Care Unit.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>In intensive-care units, immuno-compromised hosts are becoming more common, and as a result, resistant organisms can be dispersed throughout the unit. Patients can then become infected by the resistant organism. Standard source isolation procedures include placing the patient in a single-occupancy room. Aprons or gowns and gloves are used for direct patient contact, and handwashing with an antiseptic detergent is needed.</p> <p>For airborne infections, patients should be placed in a tightly sealed isolation room with separate areas for handwashing, gowning, and storage. Protective environment rooms, which have positive air pressure, can also be used. The positive air pressure is used to limit anything from the outside environment from entering and contaminating high-risk patients. These rooms are risky with if a respiratory pathogen is involved.</p> <p>MRSA (Methicillin-Resistant <i>Staphylococcus aureus</i>) can occur in patients with previous hospitalizations, intravascular lines, and those that have been admitted to the Intensive Care Unit. VRE (Vancomycin-Resistant Enterococci) can be transmitted by colonized patients or through incomplete compliance with handwashing and barrier precautions.</p>
Implications of Findings	Larger-sized single rooms are recommended to accommodate equipment, sinks in every room, and the ability to store contaminated products. Large, multi-patient rooms are not recommended, as they can increase the spread of infection if patients become infected.

Sehulster, L. & Chinn, R. Y. W. (2003, June 6). *Guidelines for environmental infection control in health-care facilities. Recommendations of CDC and the healthcare infection control practices advisory committee (HICPAC), 52(RR-10), 1-44.*

Focus of Article	To review previous guidelines and make recommendations for preventing environment-associated infections in healthcare facilities.
Type of Healthcare Facility	The material presented applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>Immunocompromised patients require rooms where positive pressure is maintained. Their time spent outside their rooms should be minimized and they should have minimal exposure to activities that may cause “aerolsolization of fungal spores” (p. 10). Respiratory protection should be provided for these patients and ventilation specifications and dust-controlling processes should be used in the protective environment units (units with a positive air flow in relation to the corridor). Patients diagnosed with or suspected of having an airborne infectious disease should be placed in isolation rooms that receive numerous air changes per hour and are under negative pressure. Patients with smallpox should also be placed in a negative pressure room, preferably one that includes an anteroom.</p> <p>Standard cleaning and disinfecting procedures should be used to control environmental contamination with antibiotic-resistant strains of bacterial culture.</p>
Implications of Findings	Patients with airborne infectious diseases should be placed in isolation.

Empirical Articles: Therapeutic Impacts: Relationship between Healing and Environment

Baker, C.F., Garvin, B.J., Kennedy, C.W. & Polivka, B.J. (1993). The effect of environmental sound and communication on CCU patients' heart rate and blood pressure. *Research in Nursing & Health*, 26, 415-421.

Focus of Study	To examine the effects of environmental sounds and communication on the cardiovascular responses of coronary care patients.
Research Design	<p>The study measured high ambient stressors, social stressors, and low ambient sounds. High ambient stressors included sounds inside and outside of the rooms such sounds of equipment and environmental sounds (telephones, toilets, carts, and vacuum cleaners). Social stressors included room conversation and hall conversation. Low ambient sounds were continuous sounds in the room from lighting, heating, and ventilation.</p> <p>Cardiac monitors were used to obtain an electrocardiogram and blood pressure was also measured every three minutes. Trait anxiety was measured at the end of data collection. Data were collected over five 45-minute periods in the early morning, midday, and in the early evening during the first day. On the second day, data were collected during early morning and midday.</p>
Sample Information & Site	The study was conducted on a 29-bed critical care unit, with private rooms, in a large Midwestern teaching hospital. The sample included 20 coronary care patients.
Findings	<p>Room conversation occurred most frequently followed by background sound, hall conversation, and environmental sound. Sound levels were highest during room conversation and were lowest for background sound. Environmental sound and hall conversation were in between the other sound levels. The loudest environmental sounds were from furniture moving, alarms, and toilet flushing in the patients' rooms. Heart levels increased during conversations. Cardiovascular reactivity was not related to trait anxiety scores.</p>
Implications of Findings	High sound levels were related to higher heart rate levels in certain instances. No mention was made in regards to room occupancy, though it was mentioned that sound levels are

probably lower on this unit with private rooms than on open intensive care units.

Baldwin, S. (1985, May). Effects of furniture rearrangement on the atmosphere of wards in a maximum-security hospital. *Hospital and Community Psychiatry*, 36(5), 525-528.

Focus of Study	To evaluate the impact that the rearrangement of furniture has on patients and on ward atmosphere.
Research Design	Furniture on seven out of ten wards was rearranged in the ward dayrooms to promote group seating. Three of the ten wards remained control wards and did not undergo any changes. Once a day, at least two group seating arrangements were established. The intervention followed a sequential format. The first phase was baseline. This was followed by the intervention and then a return to baseline. The final phase was a second intervention. The four phases lasted a total of eight weeks, with the intervals lasting a total of fourteen days. The variables measured throughout the intervention were medication rates, seclusion rates, casualty incidents, perception of the ward, and nursing reports. The investigator made observations three times a week.
Sample Information & Site	The study took place on seven male and three female wards of a maximum-security hospital in England. This hospital serves mentally disordered patients that require treatment under special security due to their tendency for violent or dangerous acts. The sample included the residents of these ten wards, with the average number of patients on the wards being twenty.
Findings	A trend exists towards an overall decrease in seclusion on the intervention wards and improved social interaction. Increased involvement in ward activities was discovered in the intervention wards, although the change was minor. The number of casualty incidents decreased on the intervention wards while the number of points earned for improved behavior and quality of work increased. Medication rates remained stable across the control and intervention wards.
Implications of Findings	A minor short-term change such as furniture rearrangement can have a moderate on the social interaction of patients in a maximum-security hospital. No mention was made in regards to room occupancy.

Baum, A., & Davis, G. (1980). Reducing the stress of high-density living: An architectural intervention. *Journal of Personality and Social Psychology*, 38, 471-481.

Focus of Study	To assess the effects of architectural intervention on residential crowding stress and poststressor effects.
Research Design	The study consisted of questionnaires, observational data, and a laboratory component. The survey was used to assess the perceptions of residents of dormitory life, including how crowded, hectic, and predictable they found life to be on their floor as well as perceptions regarding maintaining control and social experience. Observations were used to describe how the various residential conditions affected the behavior of residents. Laboratory data were used to assess the persistence and generalizability of the effects of their experiences on the dormitory.
Sample Information & Site	The study was conducted on the dormitories of a small residential liberal arts college. Three settings were used: a standard long corridor, a short corridor, and a long corridor altered by architectural intervention. This intervention included bisecting the corridor to form two groups of twenty residents. Bedrooms were also converted to lounge space. The sample included sixty-seven females who participated in the questionnaire component of the study. Fifty-four subjects were randomly selected to participate in the laboratory phase of the study.
Findings	<p>Those on the standard long corridor reported more crowding and control-related problems and less small group development than those on the other two corridors. Specifically, those on the long corridor reported less perceived control, increased difficulties in regulating social contact, perceived dormitory life to be more hectic and less controllable, and expressed less confidence in their ability to control their experiences. Those on the standard long corridor were observed to engage in less social activity than the other settings.</p> <p>Those on the altered long corridor experienced more positive interaction, more local group development, greater confidence in their ability to control events in the dormitory, and less withdrawal. Those on the both the altered corridor and the short corridor used shared spaces for social purposes,</p>

regulated social contact more effectively, and experience less crowding and less stress than those on the long corridor. In the laboratory, residents of the long corridor assumed more withdrawal positions and felt more uncomfortable than the other residents.

Implications of Findings

Architectural intervention reducing group size in residential settings can prevent stress experienced due to crowding. Specific room occupancy was not dealt with.

Beauchemin, K. M., & Hays, P. (1996, September 9). Sunny hospital rooms expedite recovery from severe and refractory depressions. *Journal of Affective Disorders*, 40(1-2). 49-51.

Focus of Study	To determine if the recovery of depressed patients is affected by their placement in brighter or darker rooms.
Research Design	Data was abstracted from admission records obtained over a two-year period (October 1993 to September 1995) in regards to the patients' diagnoses and length of stay.
Sample Information & Site	The study was conducted at a psychiatric inpatient unit in Edmonton, Alberta. The sample included 174 patients that had been admitted and discharged over the course of the study.
Findings	The average length of stay of patients was shorter in the brighter rooms than the darker rooms (16.9 days versus 19.5 days). This effect was more prominent in males as their average length of stay was 15.3 days in brighter rooms and 22.1 days in darker rooms. Females stayed an average of 17.9 days in brighter rooms and 18.6 days in darker rooms.
Implications of Findings	It appears that staying in a brighter room expedites a patient's stay, especially for males. No mention was made in regards to room occupancy.

Becher, C. (1998, March, 12). Caring about sharing. *Health Service Journal*, 30-31.

Focus of Study	To determine the view patients have of mixed-sex wards.
Research Design	Questionnaires regarding the patients view on mixed-sex wards, their age, sex, length of stay, and type of surgery undergone were mailed out to 140 patients after they were discharged.
Sample Information & Site	The study was conducted on seven surgical wards at Southmead Hospital in Bristol. The sample included eighty-seven patients who responded to the questionnaire. Sixty-four of these patients had stayed on a mixed-sex ward while twenty-three stayed on as single-sex ward.
Findings	The majority of men did not have a preference for either type of ward, while the majority of women preferred a single-sex ward. Of the types of surgeries experienced, gynecology patients were in favor of same-sex wards to the greatest extent. All other surgeries demonstrated a marginal preference towards same-sex wards. Patients who had previously stayed on a mixed-sex ward were more tolerant of them. Length of stay also impacted patients' preferences: longer lengths of stay were associated with greater tolerance of mixed-sex wards while shorter lengths of stay were associated with greater preference towards same-sex wards. Older patients seemed to be in favor of same-sex wards as well.
Implications of Findings	Most patients, especially women and those with short lengths of stay, were in favor of same-sex wards. No mention was made in regards to room occupancy.

Brown, C., Arnetz, B., & Petersson, O. (2003). Downsizing within a hospital: Cutting care or just costs? *Social Science & Medicine*, 1-8.

Focus of Study	To investigate the views of staff members in terms of their work environment, their health, and the quality of care they delivered during a period of downsizing.
Research Design	The design was longitudinal and correlational in nature. Over a period of hospital downsizing (1994-1999), staff opinions of the quality of care they delivered, their individual health, as well as features of the work environment were measured.
Sample Information & Site	The study included doctors and nurses who chose to participate. It was conducted in a tertiary care facility in Sweden.
Findings	It was discovered that quality of care delivered was the same prior to and after the downsizing occurred. Perceptions of the work environment did change, however, in that during the downsizing, their scores declined. Scores also declined for their perceptions of organizational efficiency. Perceptions of workload increased after the downsizing, and this can, in turn, affect their mental energy and the way they provide care.
Implications of Findings	Hospital downsizing did not appear to affect the quality of care provided by doctors and nurses, but it did affect staff views of their workload and mental energy, which can affect the quality of care delivered. No mention was made in regards to room occupancy.

Burden, B. (1998, January). Privacy or help? The use of curtain positioning strategies within the maternity ward environment as a means of achieving and maintaining privacy, or as a form of signalling to peers and professionals in an attempt to seek information or support. *Journal of Advanced Nursing*, 27(1),15-23.

Focus of Study	To observe the strategies women in a maternity ward use to preserve their privacy.
Research Design	Subject information was obtained through personal records in regards to the type of delivery of their child, the method of feeding they used, their position on the ward, and whether they were antenatal or postnatal. During twelve visits to the hospital, discussions were held with patients in regards to their views and strategies used in drawing the curtains around their beds.
Sample Information & Site	This study took place in a maternity ward in England. The sample included all women on the wards except those on their first day following a Caesarian section.
Findings	Women used three strategies in drawing the curtains around their beds. The first is complete closure of the curtains to withdraw from the other women for long periods of time or to change clothing or sanitary towels for a short period of time. If patients suffered from complications, which then created anxiety, they were more likely to close their curtains completely. Semi-closure of the curtains was used by postnatal women to gain solitude or by antenatal women to attract staff and gather information from them and other women. Women also used this type of closure if mixed feeding took place in the room. Partial closure was used most often by the women throughout they day. Women used this strategy to rest or to read.
Implications of Findings	Privacy was a key factor in women closing the curtains around their beds to a greater or a lesser extent. Women who felt inadequate around others or anxious due to complications were more likely to completely isolate themselves.

Cleary, T., Clamon, C., Price, M. & Shullaw, G. (1988). A reduced stimulation unit: Effects on patients with Alzheimer's disease and related disorders. *Gerontologist*, 28, 511-514.

Focus of Study	To describe the effects of a reduced stimulation unit on patient care. Patients suffered from Alzheimer's disease and related disorders
Research Design	A pretest-posttest design was used. A reduced stimulation was created to reduce the level of stimulation among patients as well as decrease their dependency on their memory. Staff, family members, and visitors were trained to use techniques effective in dealing with patients. Patients were assessed through observations and interviews. Both family members and staff filled out questionnaires regarding their satisfaction with the new unit.
Sample Information & Site	This study was conducted in Oaknoll Retirement Residence in Iowa City, Iowa. The sample included the eleven patients on the new unit.
Findings	The majority of patients improved on the new unit. All patients had been losing weight prior to their move into the new unit, and once on the new unit, eight of the eleven patients reversed the trend and had gained weight. Patient agitation levels also decreased. Family members were highly satisfied with the new ward and reported more calmness, serenity and less agitation in the patients. The satisfaction levels of nurses did not change significantly.
Implications of Findings	It appears that the patients benefited from their move to a reduced stimulation unit. No mention was made in regards to room occupancy.

D'Atri, D. A. (1975). Psychophysiological responses to crowding. *Environment and Behavior*, 7(2), 237-252.

Focus of Study	To measure if a correlation exists between degree of crowding and blood pressure levels in an enforced crowded environment.
Research Design	Interviewers collected data using standardized questionnaires. Information collected included demographic and subcultural data, personal characteristics, confinement history, mode of housing, and blood pressure.
Sample Information & Site	The study was conducted with inmates in three correctional institutions. The first institution had three modes of housing: single cell, double-occupancy cell, and a larger cell that housed three or more inmates. The second and third institutions had two modes of housing: single cell or large dormitories.
Findings	<p>On average, blood pressure was higher for inmates staying in the dormitory cells in all three institutions. Duration of confinement was found to be associated with blood pressure levels. Elevated blood pressure during the first two weeks of confinement was attributed to anxiety. Crowding affected blood pressure levels after being confined for a month and progressed thereafter.</p> <p>This study is limited by its cross-sectional nature. Also, inmates were not completely randomly assigned.</p>
Implications of Findings	Inmates staying in dormitory cells were more likely to have higher blood pressure levels than those staying in single- or double-occupancy cells.

Dolce, J. J., Doleys, D. M., Raczynski, J. M. & Crocker, M. F. (1985). Narcotic utilization for back pain patients housed in private and semi-private rooms, *Addictive Behavior*, 10, 91-95.

Focus of Study	To investigate if private rooms have an effect on the use of narcotic analgesics in pain patients.
Research Design	Patient records were reviewed for the patients' first five days of hospitalization. The type and amount of narcotic analgesic used were determined. Room type (semiprivate or private) was also used as a factor.
Sample Information & Site	The study was conducted in private and semi-private rooms for patients with pain-related back disorders. Forty patients in each type of room were studied.
Findings	No significant differences were discovered in observed narcotic use between room types for time-contingent medication. Those in private rooms were twice as likely to receive injectable request-contingent medication, as intramuscular request-contingent medication use was significantly higher in private rooms.
Implications of Findings	Patients in private rooms were more likely to request injectable pain medication.

Flaherty, J. H., Tariq, S. H., Srinivasan, R., Bakshi, S., Moinuddin, A., & Morley, J. E. (2003). A model for managing delirious older patients. *Journal of the American Geriatrics Society, 51*, 1031-1035.

Focus of Study	To assess a new model of treating elderly patients with delirium.
Research Design	Data was reviewed for patients seventy years of age or older discharged from the acute care for the elderly unit from July 1997 through June 1998. Patients suffering from delirium were placed in the Delirium Room, which is a 4-bed unit with constant monitoring by a nurse. Physical restraints were not used on patients, and medication was only prescribed as a last resort. Data reviewed included activities of daily living, demographic information, and medications taken by patients.
Sample Information & Site	The study included 69 patients discharged from the acute care for the elderly unit at Saint Louis University Hospital.
Findings	Physical restraints were not used on patients. Also, during the time period of the study, the mortality rate was zero. Patients used similar or lower amounts of medication than that found in previous sedatives. Only ten percent of patients needed sedatives. These patients did preserve function and achieved early mobilization, possibly due to the constant monitoring by nurses. This study has various limitations. For instance, the effect that certified nursing assistants had, the accuracy of the evaluations of the patients by the physicians, and the type of nonpharmacological approach that was most effective were not measured. A report of the overall prevalence of older patients on the unit was not possible. Finally, input from geriatricians may have impacted patients.
Implications of Findings	Patients suffering from delirium appear to benefit from constant nursing care in a multi-bed room.

Gotlieb, J. (2002). Understanding the effects of nurses on the process by which patients develop hospital satisfaction. *Holistic Nursing Practice*, 17(1), 49-60.

Focus of Study	To discuss how patients' evaluations of their hospital rooms and their nurses as well as locus of causality impact their hospital satisfaction.
Research Design	Questionnaires were mailed out to patients that had been discharged from the hospital. The questionnaire addressed patient satisfaction, patients' evaluation of their nurses and their hospital rooms, and their perception of locus of causality.
Sample Information & Site	The study took place at a large hospital in a major metropolitan area. The questionnaires were mailed to 849 patients who had been discharged and 232 patients responded.
Findings	Patients' evaluations of their hospital rooms affected both their evaluations of their nurses and their overall hospital satisfaction. Positive evaluations of their nurses and their rooms resulted in a positive evaluation of the hospital. Also, when patients were made to feel that they had some control over their care, they evaluated their nurses positively.
Implications of Findings	Proper staffing of skilled nurses and a positive environment in patients' hospital rooms can increase patient satisfaction as well as reduce hospital costs through a reduction in the length of stay of patients. No mention made in regards to room occupancy.

Gotlieb, J. (2000). Understanding effects of nurses, patients' hospital rooms, and patients' perception of control in the perceived quality of a hospital. *Health Marketing Quarterly*, 18(1/2), 1-14.

Focus of Study	To investigate the relationship between patients' perceptions of their hospital rooms and their nurses as well as their perception of control on their perception of hospital quality.
Research Design	Questionnaires were sent to patients after they were discharged from the hospital. The measures included pertained to the patients' perceptions and expectations of their hospital room, their nurses, and the amount of control given to them as well as the quality of the hospital.
Sample Information & Site	Questionnaires were mailed to 849 patients and responses were received from 232 patients. The subjects were all patients in a hospital in the United States.
Findings	Patients' perceptions of their rooms affected their perception of their nurses as well as the overall quality of the hospital. In addition, their perception of control affected their perception of nurses but not the quality of the hospital. Finally, patients' perception of their nurses affected their perception of the quality of the hospital.
Implications of Findings	Patients' perceptions of their rooms impacts their perceptions of the nurses and the quality of the hospital and thus, care should be taken in designing the room. No mention was made in regards to room occupancy.

Harris, P.B., McBride, G., Ross, C. & Curtis, L. (June, 2002). A place to heal: Environmental sources of satisfaction among hospital patients. *Journal of Applied Social Psychology*, 32(6), 1276-1299.

Focus of Study

To investigate sources of environmental satisfaction within the hospital setting as well as the relative contribution of environmental satisfaction to the overall hospital experience. Differences in satisfaction levels among various departments were also explored.

Research Design

Patients were interviewed during the winter of 1997-1998. The Patient Perceptions of Quality Interview-Inpatient form, as well as questions of interest, were used. Patients received one of two versions of open-ended questions. One set related to satisfaction with the hospital room, while the other set related to satisfaction with the hospital environment outside the room. Closed-ended questions were identical for all patients and referred to environmental satisfaction as well as the overall quality of care and services received.

Sample Information & Site

The study was conducted at six different hospitals owned by the IHC. Two hospitals were large in size, two were midsize, and two were small. 380 inpatients were interviewed.

Findings

Differences in levels of satisfaction among the various departments were not found. The strongest predictor of overall satisfaction was nursing care. This was followed by perceived quality of clinical care, environmental satisfaction, and satisfaction with admitting procedures. Participant satisfaction with the environment also was a strong predictor of overall satisfaction.

Sources of satisfaction with the hospital room include interior design features, social features, maintenance/housekeeping, architectural features, and the ambient environment. Satisfied patients liked the color of the walls, the artwork, had a comfortable bed, had a television and telephone that were functional, and had a room where features were easily accessible. Satisfied patients also had larger rooms, had a window with a nice view, and had an accessible bathroom. Those satisfied with the social features had a private room or had their privacy protected, and they appreciated space to accommodate family members. Overall, patients were satisfied with their rooms.

Satisfaction with the environment outside the patient room was associated with maintenance/housekeeping, interior

design features, architectural features, ambient environment, remodeling/construction, and parking.

Patients felt that architects should provide private rooms that have windows with views, space to accommodate visitors, and a bathroom in each room. The furnishings should be comfortable, and the décor should be aesthetically pleasing.

Implications of Findings

Patients prefer larger, private rooms that are aesthetically appealing and that have enough space to accommodate visitors.

Hays, P. & Beauchemin, K. B. (1998, October). Seeing ward design in a new light. *Hospital Development*, 29(9), 15-17.

Focus of Study	To describe the effects of a sunny room on patients suffering from a myocardial infarction.
Research Design	This study utilized a natural experiment. The outcomes of patients with a myocardial infarction were compared based on their stay in a sunny room or a dark room. Measures included length of stay and fatal outcomes. The study was conducted over a four-year period ending in March 1996.
Sample Information & Site	This study took place in a cardiac intensive care unit in Edmonton, Canada. The sample included 568 patients who were directly admitted to a cardiac intensive care unit with a first attack of myocardial infarction. 272 patients stayed in bright rooms and 296 patients stayed in dark rooms.
Findings	The average length of stay for all patients was 2.46 days. Men in the sunny wards stayed an average of 2.3 days while those on the dark wards stayed a mean of 2.6 days. The effect was more prominent for women. Those on the sunny wards stayed an average of 2.3 days, while those in the dark rooms stayed an average of 3.3 days. Deaths were also more frequent in the dark rooms over the four years of the study.
Implications of Findings	It appears that brighter rooms do impact the length of stay of patients as well as their outcomes. No mention was made in regards to room occupancy.

Higgs, P. F., Macdonald, L. D., & Ward, M. C. (1992, August). Responses to the institution among elderly patients in hospital long-stay care. *Social Science & Medicine*, 35(3), 287-293.

Focus of Study	To determine patients' views in regards to their stay in long-term geriatric wards.
Research Design	Patients were assessed in terms of their performance status, and levels of confusion. If their mental scores were less than four out of ten, they were excluded from the rest of the study. Those meeting the criteria were interviewed about their views of living on a long-stay ward.
Sample Information & Site	The study was conducted in long-stay wards in the South West Thames region. The sample included 291 patients staying in these facilities.
Findings	<p>The majority of patients were satisfied with their relationships with medical and nursing staff as well as other staff members. In addition, most patients were satisfied with their degree of autonomy and most did not feel lonely. Patients thought the best things in the facilities were the staff and the care provided by the staff as well. Loss of physical independence was seen as the worst thing.</p> <p>The study is limited by its selective sample in which patients with low mental scores and those that produced unintelligible responses were excluded from the sample.</p>
Implications of Findings	Overall, patients were satisfied with the care they received in these long-term facilities. No mention was made in regards to room occupancy.

Hilton, B. A. (1985). Noise in acute patient care areas. *Research in Nursing and Health*, 8, 283-291.

Focus of Study

To determine sources of sound, levels of sound, patient perceptions of sound, and which types of sounds can be modified in acute patient care areas.

Research Design

This study used an exploratory and descriptive design. Sound levels measured in the proximity of each patient over a 24-hour period. An observer sat near the patient for two 3-hour observation periods during each 24-hour period to determine the sources of sound. For each patient, an observer sat near the patient for two 3-hour observation periods, during the 24-hour interval, to determine the sources of sound. The sounds were then categorized according to source, number of occurrences, duration, and loudness. Participants were also asked to complete a short questionnaire through interviews. Questions asked pertained to how the noise affected patients, whether they thought the noise levels were acceptable, and whether the noise levels were bothersome and affected the patients' sleep.

Sample Information & Site

The study was conducted at three hospitals in a large metropolitan area in Northwest Canada. Of these three hospitals, one was a large hospital, one was a small teaching hospital, and one was a small community hospital. Intensive care units were studied at each hospital. In addition, pre- and postoperative wards for open-heart surgery were studied at the large hospital, and two medical wards were studied at the small teaching hospital. A convenience sample of 25 subjects was used and consisted of four to five subjects from each of the units.

Findings

The critical and noncritical areas in the small hospitals were quieter than those at the large hospital. Sound levels dropped at night on all units except the recovery room and intensive care unit of the large hospital. Staff, patients, and visitors created levels of talking that were higher than necessary. Equipment noises that were steady were those created by oxygen, chest-tube bubbling, and ventilator functioning. Patients were satisfied with sound levels at the large hospital's pre- and postoperative ward, the medical wards and intensive care units at the small teaching hospital, and the intensive care unit at the small community hospital. Patients were dissatisfied with the sound levels of the recovery room

at the large hospital. Noise levels that were generated outside the room were reduced when the door to the patient's room was closed.

A factor that was related to higher noise levels in the intensive care unit and recovery room of the large hospital was room occupancy. On the intensive care units of the small hospital, rooms were single occupancy, and noise levels were lower. In the large hospital, patient rooms consisted of two to eight patients and this produced unacceptable sound levels. Limitations to this study include difficulty in identifying and recording the duration of all events because some occurred simultaneously. It was also difficult, in some instances, to identify the sources of noise and some data were lost due to equipment failure.

Implications of Findings

Sound levels appear to be related to room size, in that they were lower in rooms with single occupancy rather than multiple occupancy rooms.

Holahan, C. & Seagert, S. (1973). Behavioral and attitudinal effects of large-scale variations in the physical environment of psychiatric wards. *Journal of Abnormal Psychology*, 82, 454-462.

Focus of Study	To investigate the relationship between ward design and patient behavior on two hospital wards.
Research Design	The study was a posttest control group design. Prior to conducting the study, two wards were selected based on being similar on a variety of specific criteria such as architectural structure and furnishings. Once the wards were selected, one became the control ward and remained the same while the other ward was remodeled to improve ward atmosphere through the addition of furniture and bedspreads as well as repainting. Areas were also created to facilitate social interaction. In the bedrooms, which were designed as dormitories, two-bed sections were created through the installation of partitions on the remodeled ward. Six months after the ward was remodeled, researchers observed the behavior of the patients and conducted interviews with them. The observations and interviews took place over a five-week period.
Sample Information & Site	The study took place on two wards at the City University of New York hospital. Twenty-five patients on each ward took part in the study.
Findings	Significantly more socializing and less passive behavior took place on the remodeled ward. Patients also had more positive attitudes towards the physical environment on the remodeled ward. They found it more stimulating and attractive and thus, they felt more positive towards it. A greater trend towards socialization occurred in the bedrooms on the remodeled ward.
Implications of Findings	A well-designed ward can contribute to patients feeling positive towards the ward. This, in turn, can aid in their recovery. Rooms in this design were designed as dormitories, and a trend towards more socializing occurred on the remodeled ward, though reasons why this may have occurred were not addressed.

Ittelson, W. H., Proshansky, H. M., & Rivlin, L. G. (1970, December). Bedroom size and social interaction of the psychiatric ward. *Environment and Behavior*, 2, 255-270.

Focus of Study	To determine the impact that bedroom size has on the behavior of patients. The behavior observed was grouped into three categories: isolated passive, isolated active, and social.
Research Design	Observations of patients were made using a time-sample approach. The nature of the activity on the ward, the location, and the participants were recorded. Observations were made every fifteen minutes during active periods of the day. The wards observed differed in their size and case-mix. The rooms on the wards include mainly single- and double-occupancy rooms. Each ward also contained one four-bed room.
Sample Information & Site	The site was conducted on four psychiatric wards of three large metropolitan hospitals. One ward in a city hospital, one ward in a private hospital, and two wards in a state institution were included. The sample included all patients on the wards.
Findings	Isolated passive behavior was the most frequent behavior observed in all the bedrooms. This behavior increased and social interaction decreased when the number of patients increased. Smaller rooms provide patients with greater choice in regards to activities the patients choose to undertake in their rooms.
Implications of Findings	Smaller, private rooms appear to give patients the most freedom in regards to their behavioral choices.

Janssen, P. A., Harris, S. J., Soolsma, J., Klein, M. C., & Seymour, L. C. (2001, September). Single room maternity care: The nursing response. *Birth*, 28(3), 173-179.

Focus of Study	To evaluate the responses of nurses in regards to working on a single-room maternity unit after having worked in traditional delivery suites.
Research Design	Nurses scheduled to work on a new single room maternity ward as part of a pilot project were asked to complete surveys six months prior to the new ward opening and three months after the new ward opened. Surveys were also distributed to nurses working in the traditional delivery suites as well as the postpartum ward. Questions addressed the nurses' perception of the physical setting, the quality of care given to patients, their perceived competence, and their practicing environment.
Sample Information & Site	The study was conducted at BC Women's Hospital in Vancouver, Canada. The sample included twenty nurses who worked both on the new and traditional wards, 26 delivery suite nurses, and 26 postpartum nurses.
Findings	<p>The physical space of the single rooms was greater and enabled easier accessibility of equipment and supplies. Privacy was also greater in this environment and noise levels were reduced. Quality of care was perceived as greater in the single room unit as nurses were better able to respond to the physical, emotional, and spiritual needs of the patients. Nurses also felt greater accountability for their decisions in the single rooms and felt highly competent in all aspects of their work. Job satisfaction increased for nurses once they moved to the single room unit.</p> <p>The one disadvantage of the new unit was that the medical staff was less readily available.</p> <p>The study is limited by its small sample size. In addition, previous experience, or education, or other factors could have differentiated nurses who moved to the new ward from those that stayed on the traditional ward, and thus their perceptions of their experiences may differ. Also, selection was not random and nurses could have conferred with each other during their shifts in regards to their responses.</p>

Implications of Findings

Nurses appeared to prefer working on the single room wards as they felt the quality of care was greater, the rooms offered more privacy, and they were better able to respond to the needs of the patients.

Kulik, J. A., Moore, P. J., & Mahler, H. I. M. (1993). Stress and affiliation: Hospital roommate effects on preoperative anxiety and social interaction. *Health Psychology, 12*, 118-124.

Focus of Study	To determine the relative effect on patients' preoperative anxiety levels in regards to the type of roommate assigned to them: preoperative, postoperative, and non-surgical. This study is also interested in looking at the interaction patterns of preoperative patients and their roommates.
Research Design	Patients were approached on the evening prior to their surgery and were asked to complete a questionnaire dealing with their opinions and experiences as surgical patients in the hospital. The questionnaire specifically measured preoperative anxiety (10 item subscale from Spielberger State-Trait Anxiety Inventory) and patient interactions (time spent with roommate).
Sample Information & Site	The study was conducted at the San Diego Veterans Administration Hospital. The sample included 53 men undergoing non-emergency surgeries (28 hernia patients, 9 open-heart (valve) patients, and 16 bladder/prostate patients). Patients ranged between 33 and 88 years of age with the mean age being 60 (SD = 11.19). 94% of the sample was Caucasian, 4% Hispanic, and 2% African American.
Findings	Anxiety levels were significantly higher for preoperative patients assigned to a preoperative roommate compared to a postoperative or non-surgical roommate. Patients also spent significantly more time interacting with roommates that were preoperative rather than those that were postoperative. Affiliation was greatest with other preoperative patients, intermediate with non-surgical patients, and least with postoperative patients. Discussions including both medical and nonmedical topics occurred most frequently with preoperative patients and least frequently with postoperative patients. The more similar the health problems were between roommates, the greater the proportion of the conversation was focused on medical topics.

Implications of Findings

Preoperative patients may benefit if they are assigned roommates who are postoperative or non-surgical rather than other preoperative patients. Patient distress may be reduced, as well as the amount of staff time allocated to an anxious patient. Semi-private rooms, therefore, are beneficial for a preoperative patient if the roommate is postoperative.

Lawson, B. & Phiri, M. (2000, January 20). Hospital design. Room for improvement. *Health Service Journal*, 110(5688), 24-26.

Focus of Study	To address patient satisfaction in regards to their hospital surroundings.
Research Design	During their hospital stay, patients were surveyed in regards to their condition, treatment, and outcomes. Upon discharge, patients were given questionnaires to complete that dealt with their hospital stay. Comparisons were made between orthopedic patients on a refurbished ward versus those on an older, more conventional ward. Comparisons were also made between psychiatric patients on a newer ward versus those on an older ward.
Sample Information & Site	The study took place at three hospitals in England. Orthopedic patients were treated at Poole Hospital. Psychiatric patients were treated at Mill View Hospital in a purpose-built unit and at two wards in the Freshfield Mental Health Unit in Brighton General Hospital. The sample included 237 patients treated at Poole Hospital and 151 patients treated at Mill View Hospital and Brighton General Hospital.
Findings	Overall, patients staying in the newer or refurbished units rated their experience and treatment higher than those in the older units. Those in the newer buildings were more satisfied with the appearance, layout and overall design of the unit. Caregivers, such as nurses and doctors, were given higher scores in the new buildings. The psychiatric patients on the newer units had shorter lengths of stay than those in the older units. The orthopedic patients on the newer wards required lower levels of analgesia than those on the older wards.
Implications of Findings	Hospital design impacts patient satisfaction in regards to the design itself and the treatment received. Patients treated in single rooms were more satisfied with their treatment than those on multiple-bed wards.

Leigh, H., Hofer, M. A., Cooper, J., & Reiser, M. F. (1972). A psychological comparison of patients in "open" and "closed" coronary care units. *Journal of Psychosomatic Research*, 16, 449-457.

Focus of Study	To compare the psychological states of patients on a Coronary Care Unit. Patients were either in an open, multiple-room occupancy unit or a closed, single-room occupancy unit.
Research Design	Patients willing to participate in the study were approached and interviewed. They were asked to complete questionnaires regarding their levels of anxiety, depression, agitation, and hostility as well as their perceptions of the Coronary Care Unit. Medical charts were obtained to compare the medical course of the patients on both units and patient interactions were monitored.
Sample Information & Site	The study was conducted on two Coronary Care Units in a general hospital in the United States. The two units differed in the amount of space and privacy allotted to patients in that one ward was open and busy and the other ward was closed and private. The sample included thirty-three patients on each unit.
Findings	Interaction among patients was greater on the open ward. Separation anxiety was higher on the closed ward and patients felt lonelier. Shame anxiety was higher on the open ward but patients felt they were able to express their hostility to a greater extent.
Implications of Findings	While the closed, single-occupancy rooms offered the patients more privacy, separation anxiety was higher as was the amount of loneliness experienced by these patients. The open, multiple-occupancy enabled patients to interact more, but these patients exhibited higher levels of shame anxiety.

Martin, D. P., Diehr, P., Conrad, D. A., Davis, J. H., Leickly, R., & Perrin, E. B. (1998). Randomized trial of a patient-centered hospital unit. *Patient Education and Counseling*, 34, 125-133.

Focus of Study	To compare patient outcomes on the Planetree Model Hospital Unit with other medical-surgical units in the hospitals. Factors studied were patient satisfaction, education, involvement in health care, health behavior and compliance, health status, and use of services.
Research Design	The design included several phases. Patients were first interviewed for 20 minutes upon admission. Patients were also asked to fill out questionnaires 1 week, 3 months, and 6 months after being discharged. The interview was used to get baseline information from the patients, while the questionnaires were used to assess both short-term effects of the hospitalization as well as long-term effects on outcomes.
Sample Information & Site	<p>The study took place in a San Francisco Hospital. Patients 18 years of age or older were able to participate and were randomly assigned to a Planetree ward or a medical unit. 315 patients were on the Planetree ward while 445 were on the other wards.</p> <p>The Planetree Model is patient-oriented. The environment is home-like and soothing. Primary nurses are trained to provide personal care, to educate patients, and to promote patient involvement. Patients are trained to be partners in learning about their condition and are taught skills regarding self-care, nutrition, and healthy behaviors. Family and friends are encouraged to be involved in the care process. Art and entertainment are included in the healing process.</p>
Findings	<p>Planetree patients were significantly more satisfied with their hospital stay as well as with the unit's environment, architecture, and the technical aspects of care. They had greater opportunity to interact with other patients as well as see family and friends. They were more satisfied with the involvement of nurses and were satisfied with the education they received. Planetree patients were more likely to receive written information regarding prescription medications, special diets, and how to reduce stress.</p> <p>No differences existed for both groups in terms of physician involvement as well as long-term effects on their outcomes.</p>

In the short-term, Planetree patients reported slightly better mental health status and role functioning.

Implications of Findings

When patients are given the proper environment and education, their experience in the hospital is positive, regardless of room occupancy. No mention was made in regards to room density.

Matthews, E., Farrell, G., & Blackmore, A. (1996, September). Effects of environmental manipulation emphasizing client-centered care on agitation and sleep in dementia sufferers in a nursing home. *Journal of Advanced Nursing*, 24(3), 439–447.

Focus of Study	To determine if a change from a task-oriented care approach to a client-centered approach affects agitation levels and sleep patterns in patients suffering from dementia.
Research Design	A longitudinal design was used and consisted of four phases which each covered a four-week period. Data was collected at the end of each phase. Baseline levels of the patients' sleep and agitation were collected after phases one and two. Client-centered care was introduced after phase two, and levels of agitation and sleep were collected again after phases three and four. Task-oriented care involves mandatory institutional routines, while client-centered care involves freedom of choice for the patients.
Sample Information & Site	The study took place in a 44-bed dementia ward in a metropolitan nursing home in Perth, Australia. Participants included thirty-three patients suffering from dementia who resided on the ward.
Findings	<p>In terms of agitation, eleven agitated behaviors were displayed by at least twenty percent of the patients throughout the study. Verbal agitation significantly decreased during the day, but increased significantly during the night. Staff working the day shift were observed to be more flexible than staff working the night shift and this may have contributed to the discrepancy in the results.</p> <p>Residents were also found to have increased their daytime sleep during the first few weeks following the intervention. The time spent sleeping did return to pre-intervention levels, however, by the end of the intervention.</p> <p>Limitations of this study include the limited sample size and lack of control group. Also, the intervention on the night shift was incomplete due to inadequate staffing. Finally, the environment in which the intervention was introduced may have outweighed its therapeutic effects.</p>
Implications of Findings	The client-centered intervention did improve levels of patient agitation throughout the day, but due to its limitations, other improvements were not discovered. There was no mention of room occupancy.

Milne, D. & Day, S. R. (1986). Planning and evaluating innovations in nursing practice by measuring the ward atmosphere. *Journal of Advanced Nursing*, 11, 203-210.

Focus of Study	To examine factors that impact the patients' and nurses' perspectives of the ward atmosphere in a psychiatric day hospital.
Research Design	Patients and nurses completed the two versions of the Ward Atmosphere Scale (ideal and real) at two baseline phases and then after an intervention was implemented. The intervention included training staff on implementing and revising the therapeutic program. They were trained in behavioral therapy and anxiety management. The intervention was introduced to increase levels of support, and to increase involvement, spontaneity, and program clarity.
Sample Information & Site	This study took place in the National Health Service (NHS) psychiatric day hospital, which is located in a large traditional psychiatric hospital. The sample included staff (6) and patients (41) of the day hospital.
Findings	The perspectives of ward atmosphere increased for both nurses and patients after the intervention was put into place. This effect was only noticeable in acute care patients though, and not in chronic care patients, as they did not receive the therapeutic intervention.
Implications of Findings	Ward atmosphere can be improved in the psychiatric day ward if the therapeutic program is improved to take into consideration the needs of staff and patients. No mention was made in regards to room occupancy.

Morgan, D. & Stewart, N. (1999, January). The physical environment of special care units: Needs of residents with dementia from the perspective of staff and family caregivers. *Qualitative Health Research*, 9(1), 105-119.

Focus of Study	To describe the relationship between environment and behavior in a dementia care setting.
Research Design	Residents of a high-density special care unit (SCU) were moved to a low-density special care unit upon completion of the new building. Patient size on the new unit decreased from sixty-nine on the old unit to twenty. Patients were also given larger rooms that were private, compared to the multiple occupancy rooms on the old unit. Staff and family members were interviewed three months after the patients had moved in regards to their perceptions of the new unit.
Sample Information & Site	This study took place at a 286-bed long-term facility that provided care to patients suffering from dementia. Staff and family members of the patients took part in the study. The sample included four registered nurses, five resident attendants, and nine family members. The researchers based their sample size on theoretical saturation.
Findings	<p>Resident safety on the new ward was in question based on the corridor design. Staff members felt that it was more difficult than in the previous ward to monitor the patients. Critical to the participants was an environment that was similar to that which the patients experienced prior to entering the facility. The old unit was seen as a happy family because of the close proximity between patients and staff as well as the busy atmosphere. The new unit was seen as more institutional because of the lower density and decrease in activities. The private rooms were favorable because family members were able to personalize the rooms to a greater extent and patients had greater privacy.</p> <p>There was a significant decrease in disruptive behavior on the new units due to less stimulation. Some participants, however, found that there was too little stimulation. Social interaction was encouraged in the rest areas along the corridors, which also enabled the patients to rest. Social interaction did decrease on the new units, though, due to greater dispersion between staff and residents.</p>

Implications of Findings

Overall, the participants of the study were satisfied with the new unit. The private room gave the resident more privacy and helped create a more home-like environment.

Nguyen, P. L. N., Briancon, S., Empereur, F., & Guillemin, F. (2002). Factors determining inpatient satisfaction with care. *Social Science & Medicine*, 54, 493-504.

Focus of Study	To identify factors associated with patient satisfaction in medical and surgical care.
Research Design	Patients were contacted on the first day of hospitalization and were asked to participate in the study. If they consented, research assistants collected sociodemographic data as well as information on their health status. Two weeks after being discharged, patients were mailed questionnaires regarding their hospital experiences and their satisfaction with their hospital stay.
Sample Information & Site	The study was conducted at Nancy University Hospital in France. Subjects included patients with cardiovascular, respiratory, urinary, and locomotor system diseases. 684 patients participated.
Findings	<p>Overall, most patients were satisfied with their stay. The two strongest predictors of higher satisfaction were older age and better self-perceived health status when admitted. Those that stayed in private rooms were more satisfied with admissions, the hospital environment and staff, information, overall quality of care, and recommendations/intentions. Those who did not choose the hospital they stayed in were twice as likely to complain about their hospital stay.</p> <p>The results of this study are limited by its sampling bias, in that some patients were excluded from the study. The response rate was good, at 78%, but it may have been better if the questionnaires were shorter in length.</p>
Implications of Findings	Patients in private rooms appeared to more satisfied than those in multiple occupancy rooms on a variety of factors such as the overall hospital environment and the quality of care they received.

Pattison, H. M. & Robertson, C. E. (1996). The effect of ward design on the well-being of post-operative patients. *Journal of Advanced Nursing*, 23, 820-826.

Focus of Study	To examine the effect of ward design on the patients' experience of being in the hospital and on their well-being as well as to determine their preferences in ward design.
Research Design	Questionnaires were administered to patients spending more than 5 days in either the Nightingale ward or the Bay ward of the hospital. Questionnaires included 63 questions pertaining to sleep, friendships, privacy, and isolation. The scales used were the Disturbance Due to Hospital Noise Questionnaire (Topf, 1985) and the Hospital Anxiety and Depression (HAD) scale (Zigmond & Snaith, 1983). The patients were individually interviewed between 18:00 and 22:00 on the fifth postoperative day over a six week period.
Sample Information & Site	The study took place on two gynecological wards of a hospital in the United Kingdom. 64 female patients participated, 32 on the Nightingale ward and 32 on the Bay ward. The average patient age was 43.6 (SD = 14.4) on the Bay ward and 47.1 (SD = 13.7) on the Nightingale ward. The design of the Nightingale ward includes a long open corridor which enables nurses to clearly view all their patients at one time. The Bay ward design incorporates bays of four or more beds parallel with the corridor and the external wall.
Findings	This article compares the layout of multiple occupancy rooms on different wards. On the Nightingale ward, patients felt contact with nurses was better, noise levels were higher, privacy was greater, and sleep disturbances were greater (although this result is not significant). On the Bay ward, patients were concerned with the lack of information regarding the whereabouts of the nurses and the activity of the rest of the ward. These patients also felt a lack of auditory privacy on the bay ward due to disturbing noises (ex. talking in the hallway, intercoms, call buttons, and radios and televisions). Patients on both wards felt they were part of friendly groups and anxiety and depression were not related to the ward design. 75% of patients surveyed preferred the Bay ward.

Implications of Findings

Neither ward was overwhelmingly better. Patients preferred the Bay ward, which suggests that this design should be continued. Changes could be made, however, to improve the patients' well being (ex. noise levels). No mention of a comparison with single occupancy rooms was made.

Peltier, J. W., Schibrowsky, J. A., Cochran, C. R. (2002, Summer). Patient loyalty that lasts a lifetime. *Marketing Health Services*, 22(2), 29-33.

Focus of Study	To determine if the nurse-patient and physician-patient interactions impact the quality of care received by obstetrics patients as well as their loyalty toward the hospital.
Research Design	Questionnaires were mailed to obstetrics patients from the previous twelve months. Measures on the questionnaire included those pertaining to care given by nurses and physicians as well as those pertaining to patient loyalty towards the hospital.
Sample Information & Site	The study took place at a large metropolitan hospital. Questionnaires were mailed to 505 obstetrics patients, and responses were received from 193 patients.
Findings	The patients' perceived quality of care as well as their loyalty toward the hospital is a function of a wide range of nurse and physician performance variables. Prior to delivery, physician-patient communication, as well as control given by nurses, were most critical to quality of care received. During delivery, communication with nurses and interactions with physicians were most important in determining quality of care. After delivery, communication with physicians and nurses as well as communication between nurses and other caregivers was most important. Loyalty is a function of the amount of decision-making control given to patients by physicians.
Implications of Findings	Patients' quality of care and their loyalty toward the hospital is dependent upon the care given to them by their physicians and nurses as well as the amount of control given to them. No mention was made in regards to room occupancy.

Rogers S. (2001-2002, Winter). Mixed gender wards: What does the evidence indicate?
Hospital Quarterly, 5(2), 77-84.

Focus of Study	To address the issue of a mixed gender ward and its impact on patient transfers, patient admissions, staff reactions, and financial costs.
Research Design	Surveys were given to patients, front-line nurses, and nurse managers to complete. These surveys addressed patient acceptance of mixed-gender rooms and the beliefs of nurses regarding these rooms. Data transfers for November 2000 were reviewed to measure costs incurred with patient transfers.
Sample Information & Site	The study took place at the University Health Network in Toronto. This includes three hospitals: Toronto General, Toronto Western, and Princess Margaret. The sample includes 116 patients; 38 were from Princess Margaret Hospital, 31 were from Toronto General, and 47 were from Toronto Western.
Findings	<p>In terms of costs, hospitals could save money if patients were not transferred to accommodate gender issues. These transfers accounted for 8-10% of all patient transfers; hospitals could save from \$58,800 to \$277,200 by not performing these types of transfers. These savings are only incurred, however, if these patients are not moved to same gender wards after being allocated to mixed gender wards. Of the patients surveyed, 65% of patients stated that they would accept placement in a mixed gender ward. The number increased to 76% if placement in a mixed gender wards meant faster admission.</p> <p>The majority of nurses (81%) and nurse managers (63%) felt that mixed gender wards were not a good idea. Furthermore, 68% of nurses and 67% of nurse managers thought mixed gender wards would make the work of nurses more difficult. Nurses felt that mixed gender wards would be difficult to accept by alert and oriented patients, elderly of confused patients, young patients, old patients, female patients, and religious patients, to name a few.</p>

Implications of Findings

Patients appear to accept mixed-gender room placement, especially if it is related to faster admission for the patient. Nurses, on the other hand, are not in favor of mixed gender room placement.

Singer, A. J., Sanders, B. T., Kowalska, A., Stark, M. J., Mohammad, M., & Brogan, G. X. (2000, January). The effect of introducing bedside TV sets on patient satisfaction in the ED. *American Journal of Emergency Medicine*. 18(1), 119-120.

Focus of Study	To measure the effect of a bedside television set on patient satisfaction
Research Design	A prospective, randomized, controlled, unblinded clinical trial was used. A trained research assistant recorded information pertaining to the patient such as demographic information and room assignment. Patients' satisfaction and length of stay was evaluated using a 100-mm visual analogue scale and a reversed 7-point Likert-type scale.
Sample Information & Site	The study took place in the emergency room of a suburban tertiary care center. The sample included 181 patient, of which 77 were assigned to a room with a bedside television set and 104 were assigned to a room without a bedside television set.
Findings	<p>Patient satisfaction was determined to be the same regardless of whether or not there was a bedside television set in the room. Length of stay did impact patient satisfaction, as those who were required to stay longer than their expected length of stay were less satisfied than those who stayed the same or less than expected.</p> <p>Results may have been different if the televisions offered more variety in channel selection (only 11 channels were available). Also the presence of a television set may have had more impact on patient satisfaction in lower acuity areas of the hospital.</p>
Implications of Findings	Bedside television sets do not impact patient satisfaction. No mention was made in regards to room occupancy.

Spaeth, G. L., & Angell, M. F. (1968). Preference of ophthalmic patients for multi-bedded hospital rooms. *Archives of Ophthalmology*, 79, 362-365.

Focus of Study	To investigate the preference for multi-bed or private rooms among ophthalmic patients.
Research Design	Patients admitted or discharged from this facility were included in the study. Upon admission, patients were asked to complete a questionnaire that requested information including age, sex, previous hospitalizations, the patients' opinion of their visual ability, and their preference for room type. Patients discharged during this time were also asked to complete a similar questionnaire.
Sample Information & Site	The study was conducted at Wills Eye Hospital in Philadelphia. The sample included 254 patients completing questionnaires upon admission and 376 patients that completed questionnaires when discharged.
Findings	<p>Those completing the questionnaires upon admission preferred a multi-bed room. The most important factor influencing room preference was previous hospitalization. Those who did not have any prior experience as a hospital patient preferred the single-occupancy room by a small margin. Those who had previous experience as a hospital patient were approximately nine times more likely to prefer a multi-bed room.</p> <p>Of patients that completed the form both upon admission and discharge, significantly fewer patients wanted private rooms after their stay while significantly more patients wanted rooms with more than four beds.</p> <p>Sensory deprivation of these patients did not influence their need for assistance by roommates. Also, economic factors did not impact the patients' room preference. Only nine percent of patients, after discharge, preferred a private room if cost was no object.</p>
Implications of Findings	The majority of ophthalmic patients preferred multi-bed rooms to single-occupancy rooms.

Thompson, J. D. & Goldin, G. (1975). A patient interview study: What do patients like? In J. D. Thompson & G. Goldin (Eds.), *The hospital: A social and architectural history* (pp. 270-275). London: Yale University Press.

Focus of Study	To determine what patients prefer in terms of their hospital rooms during their hospital stay.
Research Design	Patients were interviewed during their hospital stay. Questions were asked to determine the specific preferences of patients in regards to the features of their hospital room.
Sample Information & Site	The study took place at Yale-New Haven Hospital and Genesee Hospital in Rochester, New York. A total of 505 patients were interviewed. Patients at Genesee Hospital were in single-occupancy rooms, while those at Yale-New Haven Hospital were in single- and multiple-occupancy rooms.
Findings	<p>The majority of patients at Yale-New Haven Hospital felt the windows were the most positive feature of the rooms. Those at Genesee Hospital, whose beds faced the corridor and not the window, enjoyed the opportunity to view what was occurring in the corridor.</p> <p>Patients felt that a sense of security was the most important feature a hospital could offer. Hospital noise did not bother the majority of patients in either hospital. Those in four-bed rooms were bothered, however, by the other patients in their rooms as well as their visitors.</p>
Implications of Findings	Although the patients' preference for room occupancy was not studied directly, patients at Yale-New Haven hospital in rooms containing four patients were bothered by the other patients in the room.

Topf, M. (1985). Noise-induced stress in hospital patients: Coping and nonauditory health outcomes. *Journal of Human Stress, Fall*, 125-134.

Focus of Study	To examine the impact of noise on a patient's health as well identify the mechanism that links noise-induced stress with coping and health.
Research Design	Data was collected over an eight-month period. Patients were randomly assigned to a control group or to a group that received instruction for control over hospital noise. Questionnaires were used to measure objective noise, sensitivity to noise, the degree of stress caused by noise, coping strategies for controlling noise, and social desirability. The seriousness of the patients' illness was measured by the amount of time spent in surgery. Self-report measures were used to assess post-operative surgery.
Sample Information & Site	The study included 150 male surgery patients at a large metropolitan Veterans Administration Hospital.
Findings	It was discovered that objective noise, greater noise-induced stress, and greater sensitivity of the person to noise were positively related to greater exercised control over noise. Greater control over noise was exercised by patients who had a greater sensitivity to the noise, regardless of the level of objective noise. Patients were more likely to use cognitive strategies to control noise. Older patients were less likely to exert control over noise. Instruction for control over noise did not predict the use of greater coping strategies. Limitations of this study include the use of self-report data, correlational data, and an exclusive group of male subjects in a military hospital.
Implications of Findings	Sensitivity to noise is a large predictor of the use of coping strategies over hospital noise. No mention was made in regards to room occupancy.

Tyson, G. A., Lambert, G., & Beattie, L. (2002, June). The impact of ward design on the behaviour, occupational satisfaction and well-being of psychiatric nurses. *International Journal of Mental Health Nursing*, 11(2), 94-102.

Focus of Study	To determine the effect that ward design has on nurses in a psychiatric ward.
Research Design	<p>Nurses were observed six months prior and six months after their relocation to a new psychiatric ward, which included both long-stay and acute care units. Observations included measures pertaining to the interaction of nurses with patients and staff, as well as their tasks and other duties completed. Questionnaires were also mailed to nurses that measured their levels of burnout and personal accomplishment, their emotional exhaustion, and their depersonalization towards patients.</p> <p>The long-stay unit was designed to have private bedrooms. The acute care unit included single occupancy rooms, double occupancy rooms, and four-bed occupancy rooms.</p>
Sample Information & Site	<p>The study took place in a psychiatric hospital in Australia. The sample included forty nurses from the new ward and forty nurses from the old ward. The composition of nurses was virtually the same for both wards in regards to their gender and rank.</p>
Findings	<p>It was discovered that nurses on the new ward suffered from greater burnout. Nurses working on the new long-stay unit also had higher depersonalization scores. Advantages of the new ward included more aesthetic and pleasing environments, increased privacy and personal space for patients, and the atmosphere increased morale and provided a better therapeutic environment. Disadvantages of the new ward were cramped facilities and inappropriate client mix in the long-stay ward, and small offices and understaffing in the acute care ward. Nurses on the acute care ward also found it difficult to observe patients due to the increased space and privacy and staff were now more isolated. These nurses found their jobs to be more stressful on the new ward. The majority of the nurses did rate the new wards as better for the patients.</p>

Implications of Findings

While the nurses felt that the new wards were better for patients, they also noted that the design made their jobs more stressful and increased their levels of burnout. The new rooms, including all private rooms for patients on the long-stay ward and a few private rooms for patients on the acute care ward, enabled patients to have greater privacy and more space.

Ulrich, R. (1984, April). View through a window may influence recovery from surgery. *Science*, 224(4647), 420-421.

Focus of Study	To investigate whether having a room with a window view of a natural setting impacts the recovery of patients.
Research Design	Records were obtained for patients assigned to the second and third floors of a three-story hospital. The data included the length of stay of patients, the complications suffered, the amount of analgesics and tranquilizers, barbiturates, and anti-anxiety drugs taken as well as the notes made by nurses. The rooms patients stayed in either had a view of a brown brick wall or a small stand of trees. Rooms were all double occupancy and were nearly identical in all facets besides their view.
Sample Information & Site	Records for patients staying in a suburban Pennsylvania hospital during 1972 and 1981 were obtained. The sample included forty-six patients who had undergone cholecystectomy.
Findings	<p>Patients with a view of trees had a shorter length of stay in the hospital and took a smaller amount of analgesics between their second and fifth days of treatment. Those with a view of trees also received more positive comments from the nurses.</p> <p>The study is limited by the “built” view provided to patients. Results may be different if patients had different views such as a busy city street.</p>
Implications of Findings	The nature of the view patients have from their windows appears to have some effects on their recovery. While the rooms in the study were double-occupancy, no mention was made in regards to the effect room occupancy had on the patients’ outcomes.

Verderber, S. (July, 1986). Dimensions of person-window transaction in the hospital environment. *Environment and Behavior*, 18(4), 450-466.

Focus of Study	To determine the effect of windows on patient outcomes.
Research Design	A photoquestionnaire was used and illustrated a range of rooms from being windowless to having windows. Pictures were rated on a five-point scale. Patients were also asked to complete ten written questions which addressed the preference of patients, their satisfaction levels with windows on their unit, and the extent to which patient and staff members engaged in behavior associated with having windows in one's room. Questions were also included regarding the ideal windows and views from these windows.
Sample Information & Site	The study was conducted on the physical medicine and rehabilitation units of six hospitals. Subjects included 125 staff members and 125 inpatients.
Findings	In terms of the photos, most subjects preferred views from the therapy room that included trees and lawns, the surrounding neighborhood, people outside, and near and distant vistas. The depiction of nature appears to help in satisfying one's informational needs. Artificial views were less preferred than real views. Rooms with small and poorly positioned windows were the least preferred. Those in hospitals with poor views or no windows at all were unsatisfied. Staff and patients responded positively to potted plants in rooms.
Implications of Findings	Patients prefer rooms with windows that have pleasant views. No mention was made in regards to room occupancy.

Volicer, B. J., Isenberg, M. J., & Burns, M. W. (1977). Medical-surgical differences in hospital Stress. *Human Stress*, 3, 3.

Focus of Study	To measure the difference in scores of psychosocial stress due to hospitalization between medical and surgical patients.
Research Design	Interviews were conducted with both medical and surgical patients. Information was obtained on patient characteristics such as age and number of previous hospitalizations as well as their scores on the Hospital Stress Rating Scale (HSRS). Patient charts were used to obtain information pertaining to the patients' diagnoses. Two weeks after they had been discharged, the patients were interviewed again to report on their physical status.
Sample Information & Site	The study was conducted at a community hospital in the United States. Interviews were conducted with 880 medical and surgical patients, and complete data was obtained for 535 of these patients.
Findings	Scores on the stress scale were correlated with the patient's age, number of previous hospitalizations, number of years since last hospitalization, and seriousness of illness. Surgical patients reported higher stress scores than medical patients. This occurred particularly for factors representing unfamiliarity of surroundings, loss of independence, and threat of illness. Medical patients experienced more stress in terms of financial problems and lack of information. No differences were observed in terms stress associated with problems with medications and factors related to separation from others.
Implications of Findings	Surgical patients appear to suffer from greater stress than medical patients, although the factors that are related to increased stress vary for both types of patients. No mention was made in regards to room occupancy.

Non Empirical Articles: Therapeutic Relationship between Healing and Environment

Anonymous. (2001, December). Poor customer service has significant impact on bottom-line results. *Hospital Peer Review*, 26(12), 167-168.

Focus of Article	To describe factors that have an impact on patient satisfaction.
Type of Healthcare Facility	The information in this article pertains to hospitals in the United States.
Recommendations for Healthcare Setting	When the satisfaction of patients in regards to their hospital stay is low, the hospital may suffer financial implications. Nurses with negative attitudes can have long-term negative consequences for hospitals as patients are not satisfied with the care they received. Employee morale needs to be high to prevent job turnover and staff shortages. Communication between staff and family members and patients is important and patients' expectations must be managed. Responses to complaints should be quick to prevent further complaints. Finally, doctors want to feel appreciated and they are happiest when a competent staff is working for them.
Implications of Findings	Patient satisfaction can improve if the hospital staff is positive and patients are dealt with in a timely manner. This, in turn, may impact hospital finances. No mention was made in regards to room occupancy.

Biley, F. (1993). Ward design: Creating a healing patient environment. *Nursing Standard*, 8(5), 31-35.

Focus of Article	To demonstrate how patient environments affect the patients' recovery.
Type of Healthcare Facility	The material presented in this article pertains, for the most part, to hospitals in England.
Recommendations for Healthcare Setting	Hospital design, in the early days, paid attention to aesthetic and functional features of the environment. In the twentieth century, with the advancement of technology, hospitals spent more money on technology rather than on the design of the hospital. In recent years, the focus has once again shifted to the aesthetic features of the environment. Hospitals are incorporating bright, open spaces, natural light, artwork, and color co-ordination. Illustrations featuring natural scenes have a positive effect on the physical and mental states of patients. Cool colors, such as blue and green, help to promote relaxation. Warm colors, including red, orange, and yellow, promote activity, while neutral colors minimize attention. The control of undue noise can also help in the reduction of patient stress.
Implications of Findings	Innovations in design, such as attention to color, use of natural light, and incorporation of artwork, can help reduce the stress of patients and increase the speed of recovery from an illness. No mention was made in regards to room occupancy.

Cabrera, I. N., & Lee, M. H. M. (2000). Reducing noise pollution in the hospital setting by establishing a department of sound: A survey of recent research on the effects of noise and music in health care. *Preventive Medicine, 30*, 339-345.

Focus of Article	To propose a solution to reduce patients' stress and anxiety in a hospital setting by using music therapy.
Type of Healthcare Facility	The suggestions in the article apply to hospitals in the United States.
Recommendations for Healthcare Setting	The authors note that noise pollution causes increased amounts of anxiety, pain perception, loss of sleep, and prolonged convalescence in the population. They further suggest that a problem in hospitals is that the noise levels are significantly higher than the recommended levels, and this has been correlated with increased length of stay for patients as well as burnout symptoms among critical care nurses. They recommend that excess noise be replaced with carefully monitored music. A "Sound Control Center" should be established throughout the hospital. It would be responsible for reducing noise levels as well as providing a center for music therapy. Music has been proven to successfully reduce anxiety prior to and during surgery and is a practical source for alleviating pain.
Implications of Findings	With the installation of a "Sound Control Center," excess noises in a hospital can be reduced. With the induction of music therapy, patients may experience reduced anxiety and improvement in their health. No mention was made in regards to room density.

Davis J.B. (2001, May 28). Channeling calm. Hospitals turn to innovative TV to promote healing in their patients. *Modern Healthcare*. 31(22), 26.

Focus of Article	To describe the Continuous Ambient Relaxation Environment (C.A.R.E.) television channel available in hospitals.
Type of Healthcare Facility	The information in this article pertains to hospitals in the United States.
Recommendations for Healthcare Setting	The C.A.R.E. television channel is a 24-hour channel that enables viewers to watch programming that revolves around nature scenes accompanied by music. It is believed that this channel can help to relax patients and promote a therapeutic environment. It appeals to hospital officials who promote healing through environmental cues and building design. The cost of initial set-up is \$8000 per hospital and a monthly subscription fee of \$200.
Implications of Findings	The C.A.R.E. channel can help patients heal through its focus on nature and music. No mention was made in regards to room occupancy.

Fottler, M. D., Ford, R. C., Roberts, V., Ford, E., & Spears, J. (2000, March/April). Creating a healing environment: The importance of the service setting in the new consumer-oriented healthcare system. *Journal of Healthcare Management*, 45(2), 91-107.

Focus of Article	To examine the importance in determining patient satisfaction, promoting patient healing and well-being, and improving employee attitudes.
Type of Healthcare Facility	The material presented in this article applies to hospitals in general.
Recommendations for Healthcare Setting	<p>A clean, safe hospital environment that is easy to use can improve patients' satisfaction and the quality of their experience. It is important for patients and their family members to feel that their medical, psychological, and social needs have been met. A patient-focused design increases a sense of personalization and allows for maximum opportunities for interaction between patients and their family members. The patients' experience can be enhanced through the use of natural light, noise control, appropriate temperature, and attractive décor. The spatial layout of the design should enable patients to have a sense of orientation throughout the facility.</p> <p>Staff members want to work in an environment that is clean, organized, and comfortable.</p>
Implications of Findings	A well-designed setting can have a positive impact on staff members and can improve patient satisfaction and clinical outcome. No mention was made in regards to room occupancy.

Hancock, T. (1999). Creating health and health promoting hospitals: A worthy challenge for the twenty-first century. *Leadership in Health Services, 12*(2), viii.

Focus of Article	To examine ways in which hospitals can promote health.
Type of Healthcare Facility	The material presented in this article applies to hospitals in general.
Recommendations for Healthcare Setting	<p>Healthy hospitals create a healing environment for patients and a healthy workplace for staff. The physical environment of the hospital has a significant impact on the social and mental well-being of patients, and thus, the physical environment should not be damaging to the health of patients. The social environment can also affect the physical state of patients. Pleasing environments can be created through the use of color, texture, form, plants, and elements of nature. The creation of a home-like setting is also satisfying for patients.</p> <p>In a healthy hospital, patients and their family members are viewed as active participants in healthcare. Patients and their family members should be fully informed, have access to information, and be involved in the decision-making process. Staff members need to respect the needs of patients. When patients are at ease and in a nurturing environment, they will heal more rapidly.</p> <p>Communication among staff members should be facilitated and the environment should be composed and uncluttered to facilitate a positive working environment for staff members.</p>
Implications of Findings	Healthy environments help put the patient at ease and facilitate a rapid recovery. No mention is made in regards to room occupancy.

Hosking, S. & Haggard, L. (1999). The human factor. In S. Hosking and L. Haggard, *Healing the hospital environment: Design, management and maintenance of healthcare premises* (pp.159-171). London: Routledge.

Focus of Article	To describe aspects of hospitals that can improve patient conditions.
Type of Healthcare Facility	The material presented in this article applies to hospitals in general.
Recommendations for Healthcare Setting	Patients expect that the treatment they receive should be appropriate for their conditions. Noise in the environment can increase patient stress. Unpleasant noise, however, is tolerated when the noise is identified and deemed necessary. Control of noise is important for the recovery of patients, as tolerance of noise is lower during illness. Pleasant smells can contribute positively to the recovery of patients. This can be achieved through the use of aromatherapy and scented oils, among other items. Efforts are made to preserve the patients' dignity. This can be achieved through increased privacy, especially when the patient is in the bathroom, undressing, or in a great deal of pain. The sense of touch can also facilitate recovery. Patients have experienced lower stress levels when petting tame animals.
Implications of Findings	Factors such as a reduction in noise, increased privacy, and pleasant smells can contribute to a positive healing environment. No mention was made in regards to room occupancy.

Leith, B. A. (1998, August). Transfer anxiety in critical care patients and their family members. *Critical Care Nurse*, 18(4), 24-32.

Focus of Article	To describe the impact that transfer anxiety has on hospitalized patients.
Type of Healthcare Facility	The material presented in this article applies to hospitals in general.
Recommendations for Healthcare Setting	<p>Separation anxiety can result in patients who are about to be transferred. They experience anxiety because they feel they are losing a close relationship with their doctors and nurses. Patients can also experience primary transfer anxiety, which is related to the timing and type of transfer and to the disruption of interpersonal relationships. Expectant transfer anxiety can also occur if patients are not fully prepared for their transfer. Uncertainty due to a change in environment, change in routine, or lack of monitoring devices can result in patient stress.</p> <p>The experience of transfer anxiety is related to the uncertainty, which is caused by being separated from a familiar environment and personnel. It can result in stress and a decreased ability to cope with one's illness.</p> <p>Attributes of transfer anxiety include a negative perception of the transfer, psychological or physiological symptoms of anxiety, and the occurrence of these symptoms within the time frame of the transfer. Reasons for transfer anxiety include a lack of preparation for the transfer, a sudden reduction in patient monitoring, a lack of predictability of the new environment, and a decrease in the patient's control of individual care. Symptoms of transfer anxiety include insecurity, need for excessive reassurance, vigilance, and withdrawal.</p> <p>Transfer anxiety can be detected through the use of a few instruments. These include the Myocardial Infarct Stress Transfer Inventory and the Perception of Transfer as a Stressor questionnaire.</p> <p>When patients are prepared for the transfer by their nurses, they respond better to the transfer. Transfer anxiety can be reduced through structured discharge planning and through the involvement of relatives in the transfer.</p>

Implications of Findings

Transfer anxiety can adversely affect the coping ability of patients and can lead to increased stress in patients. No mention was made in regards to room occupancy.

Nicholson, L. (1993). Humanizing the patient environment. In D. K. Hamilton (Ed.) *Unit 2000: Patient beds for the future. A nursing unit design symposium* (pp. 251-253). Houston: Watkins Carter Hamilton Architects, Inc.

Focus of Article	To describe factors of the hospital environment can aid the healing process.
Type of Healthcare Facility	The material presented in this component of the symposium pertains to all hospitals.
Recommendations for Healthcare Setting	<p>In the 1980's, an emphasis was placed on making the hospital environment more warm and home-like. The hospital interior environment should create balance and harmony. In doing this, the environment must be humanized and respond to the emotional, spiritual, physical, and mental needs of the patients. Patients should also be given as much freedom and independence as possible.</p> <p>A healing environment is one which gives the patient privacy and personal space, as patients desire the flexibility to control their environment. It should also provide and encourage relaxation. Windows connect the patient to the outdoors. Space for personal belongings, as well as family members, is also necessary. Finally, pleasant surroundings help patients to heal.</p>
Implications of Findings	A positive healing environment may be beneficial for patients. No mention was made in regards to room occupancy.

Rich, M. (2002, November 27). Healthy hospital designs: Improving décor can have impact on care; Fewer fractures and infections. *The Wall Street Journal*, B1.

Focus of Article	To describe how improvements in design have therapeutic effects for patients.
Type of Healthcare Facility	The facilities mentioned in this article are the Barbara Ann Karmanos Cancer Institute in Detroit, Methodist Hospital in Indianapolis, Bronson Methodist Hospital in Kalamazoo, Michigan, and the Swedish Medical Center in Seattle.
Recommendations for Healthcare Setting	<p>The redesign at the Barbara Ann Karmanos Cancer Institute included the use of softer colors, warmer, indirect lighting, wider hallways and doors, and pullout sofas for visitors. After the renovations, sickle-cell anemia patients, on average, gave themselves 45% less self-administered pain medication. Those admitted with prostate cancer cost the hospital an average of 23.5% less than patients admitted prior to the redesign. This is mainly due to a reduction in pain medication.</p> <p>At Methodist Hospital, patient falls were reduced by 60% in the cardiac wing. This is due to redesigned rooms, which have eliminated the need for patients to be transferred from critical-care units to recovery bays.</p> <p>At Bronson Methodist Hospital, a new facility was built with only single-occupancy rooms. Doctors are now able to have more private conversations with their patients. A sharp reduction has also occurred in the number of hospital-acquired infections. The hospital has saved money because patients are no longer asking to be transferred from their rooms.</p> <p>At Swedish Medical Center, small still-life paintings were placed over cubbyholes containing equipment such as oxygen masks, suction lines, and blood-pressure cuffs in the surgical recovery room. These paintings were inserted to reduce the feeling of intimidation among patients who do not like hospital equipment.</p>
Implications of Findings	Effective hospital design can have therapeutic effects on patients and can help the hospital save money. Room occupancy was only mentioned for Bronson Methodist Hospital. The rooms in this facility are private, and the

hospital has noticed a reduction in costs and hospital-acquired infections.

Shumaker, S. A. & Reizemstein, J. E. (1982). Environmental factors affecting inpatient stress in acute care hospitals. In G. Evans (ed.), *Environmental stress* (pp.179-223). Cambridge, London: Cambridge University Press.

Focus of Article	To describe factors that affect inpatient stress in acute care settings.
Type of Healthcare Facility	The material presented in this article applies to hospitals in general.
Recommendations for Healthcare Setting	<p>A major function of hospitals is to provide services to patients with different needs. The adjustment to a hospital setting is made difficult by the vulnerability of patients. Factors of hospitals that affect a patient's level of stress are wayfinding, physical comfort, control over privacy and personal territory, and the symbolic meaning of the hospital environment.</p> <p>Aspects of the environment that can influence patient comfort are noise, temperature and humidity, lighting, body positioning, odors, and manipulation of switches. Patients are highly sensitive to hospital sounds due to pain, the nature of their illness, or their lack of control over the sounds. Sound-attenuating surfaces need to be used to reduce the amount of noise produced. When temperatures are incongruent with the needs of the patients, stress may result. Patients should be provided with individual controls in their rooms. Poor lighting can cause discomfort and unpleasant odors can be disturbing. Surfaces that reduce glare should be used and appropriate lighting should be used for various tasks. To curb odors, surfaces that do not retain odors should be used.</p> <p>Privacy serves many functions for patients, including control over personal information, an opportunity for resting, and an opportunity to discuss feelings and needs with family and friends. The nature of a patient's illness and the patient's response to the illness can impact the stress experienced in regards to privacy. The number of patients in a room as well as the presence of an interior window to the corridor, the relation of the head of the bed to the doorway, the presence of visual screening devices, and the location of the bathroom in relation the hallway all impact the privacy of patients. Using curtains around the beds, as well as lowering voices when discussing the patients' illnesses, can meet the needs of patients. A patient's control of privacy is key to design.</p>

Giving patients the ability to personalize their rooms enables them to establish their own territory and increases their sense of security and self-identity.

The design of the patient rooms can convey symbolic meaning to patients. The layout and visual and acoustical screening represent the hospital's view of importance of a patient's privacy and territoriality. The patient's territory in a multiple occupancy room is also symbolic in terms of the patient's proximity to the bathroom, the door, or closet, especially if distances are uneven among patients.

Implications of Findings

An environment that meets the patient needs and gives them a sense of control helps reduce patient stress. No specific mention is made in regards to room occupancy, though it is noted that privacy and territoriality are issues in rooms with multiple occupancy.

Solomon, N. (2003, July 15). New way of treating elderly patients with delirium defies conventional medical wisdom. Retrieved on July 16, 2003, from http://www.eurekalert.org/pub_releases/2003-07/slu-nwo071503.php

Focus of Article	To discuss a method for treating elderly patients who are delirious.
Type of Healthcare Facility	The material presented in this article applies to Acute Care for the Elderly Unit at Saint Louis University Hospital.
Recommendations for Healthcare Setting	Elderly patients who are delirious and agitated are typically treated in isolation in private or semi-private rooms. At Saint Louis University Hospital, a Delirium room, which is a four-bed intensive care unit, was created. There are no walls in the room enabling constant monitoring of the patients by nurses. Physical restraints are not used and medications are avoided, and are the last choice of treatment. Instead, nurses try to figure out why the patient is agitated. Over an 18-month study period after the unit opened, the fall rate was near zero and the mortality rate was zero.
Implications of Findings	A Delirium room with four beds has been found beneficial for elderly patients who become delirious.

Tate, J. (1980). The need for personal space in institutions for the elderly. *Journal of Gerontological Nursing*, 6(8), 439-449.

Focus of Article	To describe the needs of the elderly living in institutions.
Type of Healthcare Facility	The material presented in this article applies to institutions for the elderly.
Recommendations for Healthcare Setting	<p>The physical environment provided to residents is critical to the functioning of residents. Factors that need to be considered in the design are privacy, personal space and territoriality, and crowding. The most important qualities of the physical environment for the elderly are the amount and the arrangement of space. If their needs for privacy and territoriality are not met, negative effects, such as a sense of loss of personal control and a weakened personal identity, may occur.</p> <p>Aspects of design that promote social interactions, permit privacy, and minimize feelings of crowding are, for instance, providing private rooms, limiting the number of residents, and providing small dining areas and social lounges.</p>
Implications of Findings	The needs of privacy and territoriality of the elderly may be facilitated through the use of private rooms.

Ulrich, R. S. (2003). *Creating a healing environment with evidence-based design*. Paper presented at the American Institute of Architects Academy of Architecture for Health Virtual seminar- Healing Environments. October 10.

Focus of Article	To describe how evidence based design in regards to environmental features of hospitals can be used to improve patient outcomes.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>Evidence-based design is used to create healthcare environments that help facilitate patient outcomes, including increasing the safety of patients. Architectural features that affect patient outcomes are noise, single versus multiple occupancy rooms, positive distractions, the presence of windows and the views provided by windows, air quality, furniture arrangements, and carpeting.</p> <p>Nosocomial infections, for instance, are affected by air quality and single versus multiple occupancy rooms. In particular, infection rates are lower in single-occupancy rooms than in open wards or double-occupancy rooms. Excess noise can increase the amount of stress experienced by patients. Single-occupancy rooms appear to be quieter than double-occupancy rooms.</p> <p>One's sense of control in regards to their environment can affect a patient's stress levels. Privacy can aid in increasing control and decreasing stress levels.</p> <p>Social support can also help reduce stress and improve patient outcomes. Roommates are a source of stress for patients and incompatible roommates can lead to costly transfers and higher medication errors as a result of the transfers. When family members are able to stay with the patient, falls can be reduced, as patients are less likely to get up out of bed without assistance.</p>
Implications of Findings	To increase patient safety and improve patient outcomes, single-occupancy rooms with good air quality should be used. Single-occupancy rooms reduce the likelihood of the occurrence of nosocomial infections, patient falls, and patient transfers, and they can result in lower noise levels.

Ulrich, R. S. (1999). Effects of gardens on health outcomes: Theory and research. In C. C. Marcus & M. Barnes (Eds.) *Healing gardens: Therapeutic benefits and design recommendations* (pp. 27-86). New York: John Wiley & Sons, Inc.

Focus of Article	To describe the effects that healing gardens have on hospital patients.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	<p>Poor environmental design is associated with negative effects such as higher anxiety, increased need for pain medication, sleeplessness, and higher blood pressure. Healing gardens aid in reducing patient stress and include elements of nature such as green vegetation, flowers, and water. They help reduce stress by promoting a sense of control and access to privacy, social support, access to nature, and physical movement. Patients feel a sense of loss of control when they experience a loss in privacy, when they are not given information, when they are unable to adjust room and temperature and lighting, and when they have way-finding difficulties.</p> <p>Healing gardens can also facilitate social contact, which has been demonstrated to have a positive effect on the health status of patients.</p> <p>In terms of design, patients prefer access to nature including gardens, sitting areas, views from their rooms, and pictures of nature. Nature scenes have a positive impact on emotional, physiological, and behavioral aspects of stress experienced by patients.</p> <p>Some advantages of including healing gardens in hospital design are a reduction in stress by patients, staff, and visitors, a reduction in depression, a higher quality of life for chronic patients, reduced pain, improved way-finding, and higher patient and job satisfaction. Patients may also experience greater independence and a shorter length of stay.</p> <p>Negative aspects of healing gardens include noise and smoking, and in certain instances, sunlight.</p>
Implications of Findings	A healing garden in a healthcare setting can have many positive impacts on patients, including a reduction in the stress they experience. No mention was made in regards to room occupancy.

Ulrich, R, (1992, September-October). How design impacts wellness. *Healthcare Forum Journal*, 20-25.

Focus of Article	To describe design strategies that impact the well-being of patients.
Type of Healthcare Facility	The material presented in this article applies to hospitals in the United States.
Recommendations for Healthcare Setting	A well-designed hospital can have positive effects on the patients. These include reduced stress and anxiety, lower blood pressure, improved postoperative progress, reduced need for pain medication, and shortened length of stays. Hospitals that are poorly designed, such as those that are noisy, invade one's privacy, and interfere with social support, can increase patient stress. Facility design should foster a sense of control, access to social support, and access to positive distractions. Facilities should include gardens accessible to patients, convenient and comfortable accommodations for visitors, and elements of nature such as trees, plants, and water. Artwork can also have positive influences on patients.
Implications of Findings	A well-designed hospital can have positive effects on patients. No mention was made in regards to room occupancy.

Williams, M. A. (1995). Design for Therapeutic outcomes. In S. O. Marberry (Ed.), *Innovations in healthcare design: Selected presentations from the first five symposia on healthcare design* (pp.105-114). New York: John Wiley & Sons, Inc.

Focus of Article	To describe how hospital design can facilitate therapeutic goals.
Type of Healthcare Facility	The material presented in this article applies to all hospitals.
Recommendations for Healthcare Setting	Good hospital design should support activities that are essential to achieving desired patient outcomes. This should be achieved without adding any stress to the patients besides that which they incur due to their illness and treatment. The therapeutic environment includes the physical design and social environment that enhance therapeutic goals and activities. To achieve therapeutic goals, the design must take into account the functional requirements of patients.
Implications of Findings	Hospital design is critical to achieving therapeutic goals. No mention was made in regards to room occupancy.

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Nursing unit floor plans utilized in overview analysis by Davis Langdon Adamson:

- Swedish Medical Center – First Hill, Seattle, Washington (This floor plan has been utilized in the cost model done by BTY Group, Appendix F)
- Evergreen Medical Center – Old Patient Tower, Kirkland, Washington
- Evergreen Medical Center – New Patient Tower, Kirkland, Washington
- University of Washington Medical Center, Seattle, Washington
- Providence Newberg Medical Center, Newberg, Oregon.
- St Luke's Medical Center, in Milwaukee, Wisconsin
- Valley Presbyterian, in Van Nuys, California

Permission to share the floor plans of the following hospitals pending:

- San Joaquin General Hospital, Med/Surg.
- VA Menlo Park, Psychogeriatric floor
- University of California at Davis Medical Center, Davis Tower, 14th floor.

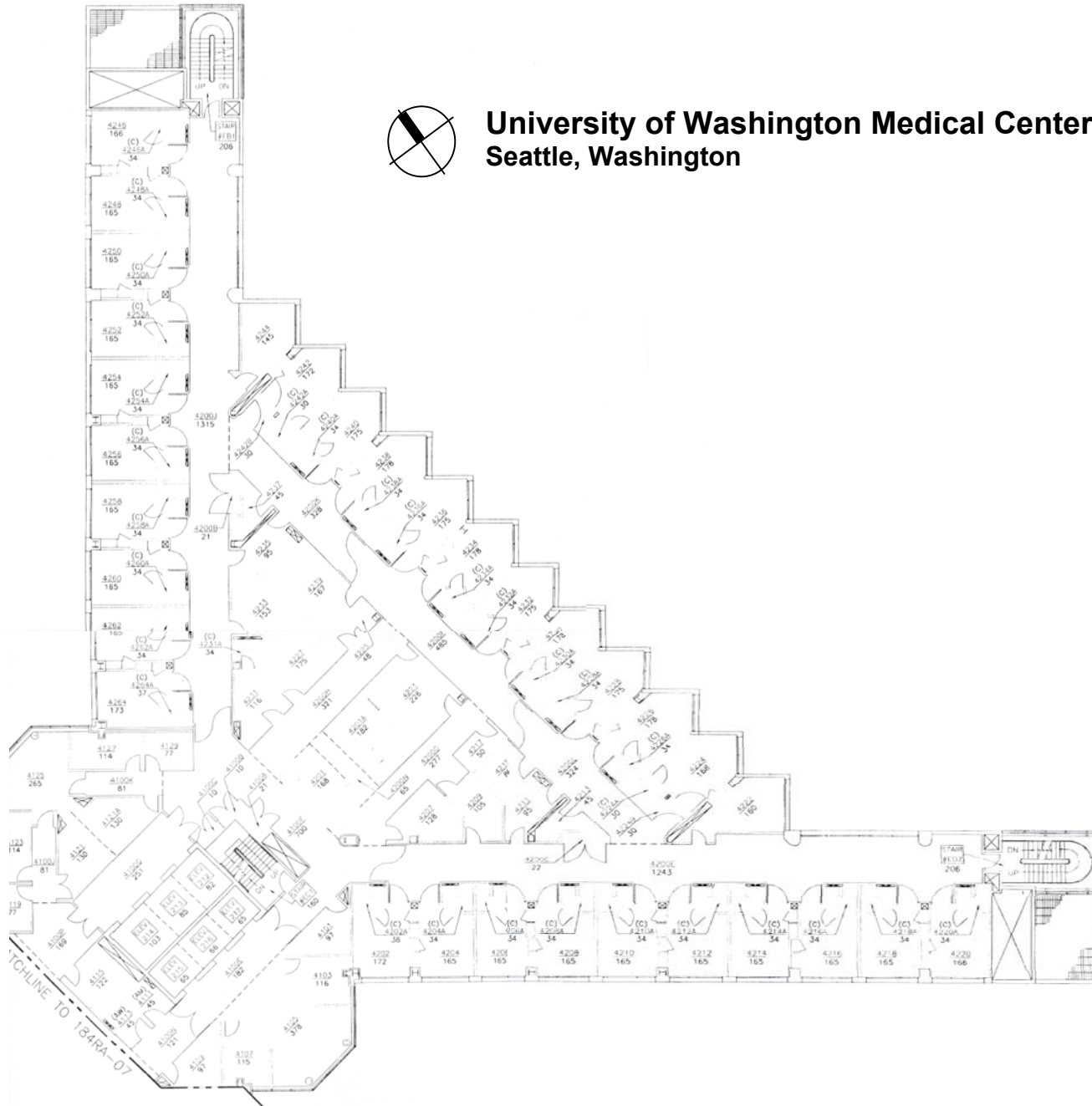
Swedish Medical Center - First Hill Seattle, Washington



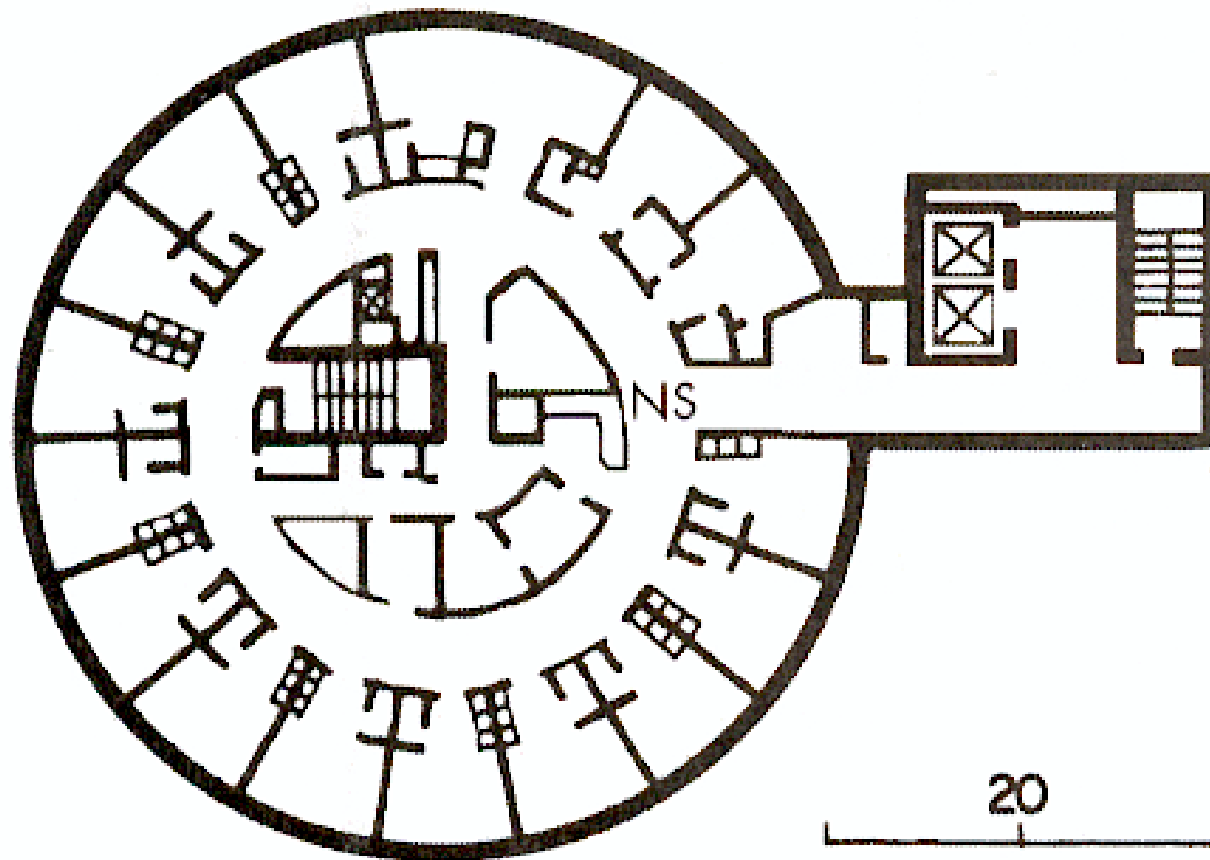
- FLOOR PLAN KEY NOTES:**
- 1 RIGHT JAMB CONDITION. SEE DETAILS 9 & 10 ON SHEET A4.0.
 - 2 DIMENSIONED DISTANCE FOR FINISHED FACE OF CORRIDOR WALL IS TAKEN ALONG THE CENTERLINE OF FINISHED WALL FROM INSIDE FACE OF FINISHED EXTERIOR WALL TO FINISHED FACE OF CORRIDOR WALL. MAXIMUM ROOM AND 8'-0" CLEAR CORRIDOR WIDTH PARALLEL TO AXIS OF BUILDING.
 - 3 CENTER POSITION IN WINDOW HEADLINE. SEE DETAIL 12 ON SHEET A8.0.
 - 4 ALONG NEW WALL WITH EXISTING CORNER OR WALL.
 - 5 ALONG FINISHED WALL WITH EDGE OF FINISHED WINDOW JAMB. SEE DETAIL 10 ON SHEET A8.0.
 - 6 SEE DETAIL FOR LOCATION OF SAMEST CHANNEL IN FLOOR SLAB AND RECESSED INFANT SECURITY WALL COMPONENTS.
 - 7 PROVIDE 1/4" x 8'-0" JOIST TRIM PROTRUSION ON ALL WALLS IN THIS ROOM.
 - 8 INDICATES KEY ANGLE WHERE NEEDED FOR CLAMPING. KEY ALL 90° ANGLES NOTED.
 - 9 SURFACE MOUNT DISCREETION KEYS CHANNEL (SLS). TOP OF CHANNEL 8'-0" AFF.
 - 10 DOOR ACTUATOR LOCATION (INTACT) - BOTTOM OF PLATE 36" ABOVE FIN.
 - 11 GRID COLUMN COVER. SEE DETAILS 14 & 24 ON SHEET A8.0. SEE DETAIL 16/18/24 FOR SILL CONDITION AT ADJACENT COLUMN WHERE SHOWN.
 - 12 LOCATION OF CENTERLINE OF MANUFACTURED HEAVILY DIMENSIONED ALONG THE WALL AT HEAD OF BED.
 - 13 OVER HEAD DOOR LOCATION (INTACT) - BOTTOM OF PLATE 36" ABOVE FIN.
- FLOOR PLAN GENERAL NOTES:**
- ALSO SEE FLOOR PLAN KEY NOTES 1-13 ON THIS SHEET.
1. NOTES ARE GENERAL IN NATURE. SOME NOTES IN THIS SECTION MAY NOT APPLY TO CONDITIONS SHOWN ON THIS FLOOR PLAN.
 2. FLOOR KEY TOPIC - "SPACE COVERED BY THIS" SHOWS OVERALL CONFIGURATION OF THE BUILDING WORK AND INCLUDES THE FOLLOWING:
 - SPACE CONFIGURATION AND PARTITION LOCATIONS WITH DIMENSIONS, WALL THICKNESS FROM FINISH FROM FINISH AND NUMBERED, AND OPENINGS WITH U.S. NUMBERED.
 - FIXED AND MOVABLE EQUIP. TYPES C/E AND O/E WITH U.S. NOS. AND (L/S/P).
 - O/E AND C/E (EQUIP. IN ENCLASURES) WITH U.S. NOS. AND (L/S/P).
 - CORNER BLANKS (C/B), CORNER ASSEMBLY (C/A) AND EXTENT OF WALL PROTECTION ASSEMBLY (W/P). SEE SECTION CROSS AND TONGUE FOR C/P TYPES. SEE SHEET A8.0 FOR W/P TYPES AND SHEET A8.0 FOR C/A TYPES.
 - EXTENT OF NEW WALLS (NEW) OVER PAINT (O/P) AND WINDOW (W/P). SEE DETAILS ON SHEET A8.0.
 3. FOR PLAN INFORMATION NOT SHOWN ON THIS PLAN SEE ENLARGED PLANS AS KEYS AND/OR AS REFERENCED ON THE ELEVATION & DIMENSIONED PLAN SCHEDULE.
 4. WORK AT EXTERIOR WALL IS LIMITED TO WORK AS NEEDED TO ACCOMMODATE FINISH-TO-FINISH-TO-FINISH OR FINISH-TO-FINISH-TO-FINISH.
 5. PLAN DIMENSIONS RELATE TO FACE OF DIM. CENTERLINE OF PARTITION OR PROJECT GRID LINES, UNLESS OTHERWISE INDICATED. DIMENSIONS SHALL BE AT 90° ANGLES AND PERPENDICULAR/PARALLEL TO ALL COMMON WALL BETWEEN FT. RING.
 6. ALL WALLS OF "PLANT" AND "PLANT" ARE IN PARTITION ROOMS ALONG THE WALL SHALL BE AT 90° ANGLES AND PERPENDICULAR/PARALLEL TO ALL COMMON WALL BETWEEN FT. RING.
 7. FOR PARTITION TYPES, NOTES, AND DETAILS SEE SHEETS A8.0 - A8.5.
 8. O/E/S COLUMN FINISHING TO BE PARTITION TYPE. SEE SHEET A8.0.
 9. FOR INFORMATION ON OPENINGS (DOORS, SCHEDULES, RELIEFS) SEE SHEETS A8.0 - A8.5.
 10. WORK DIMENSIONED ON FLOOR PLAN DOORS ARE DIMENSIONED TO EDGE OF OPENING SIZE AND SHALL BE TO INSIDE EDGE OF FRAME.
 11. SEE FRESH PLACEMENT PLANS, F2.05, F2.06, F2.08, FOR FLOOR MATERIAL, PATTERNS AND FINISHES. SEE FRESH COORDINATE SHEETS F2.04 THROUGH F2.08 FOR FRESH DESIGNATIONS IN ALL SPACES.
 12. FOR INFORMATION ON ACCESSORIES, SEE THE FOLLOWING:
 - FOR ACCESSORY TYPE AND QUANTITY SEE ACCESSORY SCHEDULE SECTION (S8.0).
 - FOR MOUNTING HEIGHTS AND PLACEMENT SEE SHEETS A8.0 AND A8.07.



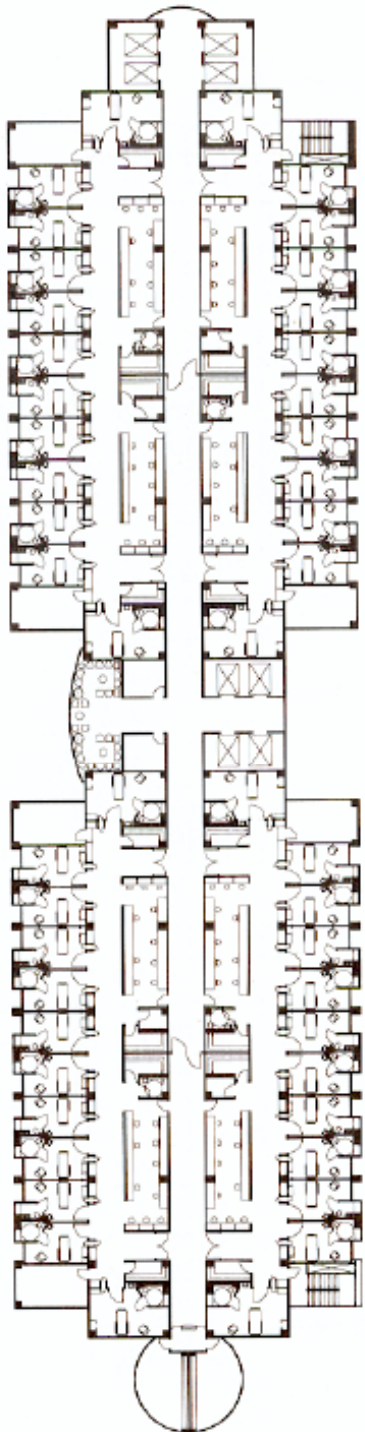
**University of Washington Medical Center
Seattle, Washington**



Valley Presbyterian
Van Nuys, California



**St Luke's Medical Center,
Milwaukee, Wisconsin**





Preliminary Comparative Cost Study

One-Bed Room vs. Two-Bed Room Cost Comparison

July 29, 2003



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1.0 INTRODUCTION

BTY Group (BTY) has been appointed by Dr. Habib Chaudhury of the Gerontology Program at Simon Fraser University, British Columbia (B.C.), to conduct a preliminary comparative study of construction costs of one-patient-bed room versus two-patient-bed room design for hospitals in the United States.

Based on a reference floor plan of a sample hospital provided by Dr. Chaudhury and unit-rate cost data obtained from our cost records of similar projects, BTY has developed a representative cost model for the above comparison.

2.0 EXECUTIVE SUMMARY

The following comparative construction costs have been derived using a sample hospital floor plan as a guide and cost data available from similar hospital projects. Both figures shown are based on one floor of the sample hospital with 28 beds.

Description	GFA (per floor)	Cost per floor	\$ per sf	\$ per Bed
One-Bed Option	20,600 sf	\$4,285,000	\$208	\$153,000
Two-Bed Option	18,800 sf	\$3,752,000	\$200	\$134,000

As this is a preliminary analysis based on broad, parametric data, these figures are more useful as a comparison between options than an absolute indication of construction cost.



3.0 AREAS

Our cost study has been based on the following Gross Floor Areas (GFA) measured in accordance with the *Guidelines Established by the Canadian Institute of Quantity Surveyors*:

Description	GFA (per floor)
One-Bed Option	20,600 sf
Two-Bed Option	18,800 sf

The reference floor plan for one level of the sample hospital provided to BTY appears to be an extension to an existing building(s) and is designed to serve twenty-eight (28) patient beds, each of which is contained in an individual room (one-bed room design). In assessing the floor area required for a two-bed room design, BTY has assumed that the total patient room areas and half of corridor areas immediately adjacent to these patient rooms would be reduced by 20% while the core area would remain the same as that required for the one-bed option.

4.0 SCOPE

The cost model **includes** all direct and indirect building construction costs normally identified by design documents. It specifically **excludes** the following:

- Professional fees and disbursement
- Planning and administrative costs
- Legal fees and expenses
- Financing fees
- Permits
- Development cost charges
- Loose furnishings and equipment
- Removal of hazardous materials
- Temporary facilities
- Site work
- Demolition and alterations
- Design allowance (e.g. contingencies to offset design changes during design phase)
- Construction allowance (e.g. contingencies to offset changes during construction)



5.0 METHODOLOGY

The comparative cost model has been prepared using historical \$ per Gross Floor Area cost data available from our projects. The Gross Floor Area (per floor) of the one-bed room option was measured directly from the reduced scale drawing provided by the client and that of the two-bed option was calculated in the manner described in Section 3.0 above.

The construction costs of the two options have been developed by applying \$ per gross floor area unit rates to their respective floor areas on an elemental basis. The elemental cost summaries of the two options can be found in Section 8 of this report. Further adjustments have been made to the elemental unit rates on several building elements for the two-bed option to take into consideration the reduced scope of work for the following items:

- Partitions
- Interior doors
- Wall finishes
- Washroom accessories
- Plumbing fixtures
- Washroom exhaust

The floor plan of the sample hospital project provided to us appears to be an extension to an existing building(s) and has likely attracted increased requirements for elevator capacity (i.e. 11 elevators) in order to serve the balance of the entire campus. For the purpose of this costing exercise, we have discounted this inflated capacity.

Please also note that costs of elevators for both options are the same as each requires a system to handle the identical capacity.



6.0 PRICING AND ESCALATION

The cost plan reflects current rates taking into account the size and nature of the project. The unit rates utilized are considered competitive for a project of this type, bid under a stipulated lump sum form of tender in an open market, with a minimum of five bids, supported by the requisite number of sub-contractors.

The cost model developed is applicable to high-rise, acute-care hospitals in the Pacific Northwest region of the U.S. and British Columbia. A location factor may be required to adjust for differences in labour and material prices for projects outside these regions.

No allowance has been made to cover costs for escalation beyond today's date. An allowance equivalent to 3% per annum should be included for further application of the derived data.

7.0 DOCUMENTATION

The estimated cost is based on the following reference drawing received:

Dwg #	Description	Date
<i>Architectural</i>		
A2.10	Floor Plan - Level 10 SE (reduced scale)	March 15, 2001

This floor plan represents a "triangular" configuration for a typical medical-surgical unit.



8.0 Elemental Analyses

BTY GROUP

PROJECT: Preliminary Comparative Cost Study
One-Bed Option

DATE: July 29, 2003
GROSS FLOOR AREA: 20,600 sf
NUMBER OF BEDS: 28 no.

Element	Gross Floor Area	Unit	Unit Rate	Amount \$	Total Cost \$	Cost/Floor Area \$/ sf	%
A1 SUBSTRUCTURE					192,000	9.32	4.5%
A11.1 Standard Foundations	20,600	sf	5.62	116,000		5.63	
A11.2 Special Foundations	20,600	sf	2.98	61,000		2.96	
A12 Basement Excavation	20,600	sf	0.75	15,000		0.73	
A2 STRUCTURE					540,000	26.21	12.6%
A21 Lowest Floor Construction	20,600	sf	1.09	22,000		1.07	
A22.1 Upper Floor Construction	20,600	sf	17.38	358,000		17.38	
A22.2 Stair Construction	20,600	sf	1.27	26,000		1.26	
A23 Roof Construction	20,600	sf	6.51	134,000		6.50	
A3 EXTERIOR ENCLOSURE					587,000	28.50	13.7%
A31 Structural Walls Below Grade	20,600	sf	2.21	46,000		2.23	
A32.1 Walls Above Grade	20,600	sf	9.13	188,000		9.13	
A32.2 Structural Walls Above Grade	20,600	sf	6.52	134,000		6.50	
A32.3 Curtain Walls	20,600	sf	0.72	15,000		0.73	
A33.1 Windows & Louvres	20,600	sf	2.89	60,000		2.91	
A33.2 Glazed Screens	20,600	sf	0.43	9,000		0.44	
A33.3 Doors	20,600	sf	0.96	20,000		0.97	
A34.1 Roof Covering	20,600	sf	3.75	77,000		3.74	
A34.2 Skylights	20,600	sf	0.42	9,000		0.44	
A35 Projections	20,600	sf	1.39	29,000		1.41	
B1 PARTITIONS & DOORS					231,000	11.21	5.4%
B11.1 Fixed Partitions	20,600	sf	7.07	146,000		7.09	
B11.2 Moveable Partitions	20,600	sf	0.10	2,000		0.10	
B11.3 Structural Partitions	included	sf	0.00	0		0.00	
B12 Doors	20,600	sf	4.05	83,000		4.03	
B2 FINISHES					175,000	8.50	4.1%
B21 Floor Finishes	20,600	sf	3.91	81,000		3.93	
B22 Ceiling Finishes	20,600	sf	2.95	61,000		2.96	
B23 Wall Finishes	20,600	sf	1.60	33,000		1.60	
B3 FITTINGS & EQUIPMENT					481,000	23.35	11.2%
B31.1 Metals	20,600	sf	0.65	13,000		0.63	
B31.2 Millwork	20,600	sf	6.87	142,000		6.89	
B31.3 Specialties	20,600	sf	3.25	67,000		3.25	
B32 Equipment	20,600	sf	1.84	38,000		1.84	
B33.1 Elevators	20,600	sf	8.21	169,000		8.20	
B33.2 Escalators & Moving Walkways	20,600	sf	0.00	0		0.00	
B33.3 Material Handling Systems	20,600	sf	2.51	52,000		2.52	
C1 MECHANICAL					1,158,000	56.21	27.0%
C11 Plumbing and Drainage	20,600	sf	12.24	252,000		12.23	
C12 Fire Protection	20,600	sf	2.93	60,000		2.91	
C13 HVAC	20,600	sf	32.09	661,000		32.09	
C14 Controls	20,600	sf	8.97	185,000		8.98	
C2 ELECTRICAL					531,000	25.78	12.4%
C21 Service & Distribution	20,600	sf	12.68	261,000		12.67	
C22 Lighting, Devices & Heating	20,600	sf	3.92	81,000		3.93	
C23 Systems & Ancillaries	20,600	sf	9.19	189,000		9.17	
Z1 GENERAL REQUIREMENTS & FEES					390,000	18.93	9.1%
Z11 General Requirements	7.00%			273,000		13.25	
Z12 Fee	3.00%			117,000		5.68	
NET BUILDING COST					\$4,285,000	208.01	100.0%
\$/ BED					\$153,000		

BTY GROUP

PROJECT: Preliminary Comparative Cost Study Two-Bed Option	DATE: July 29, 2003 GROSS FLOOR AREA: 18,800 sf NUMBER OF BEDS: 28 no.
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Element	Gross Floor Area	Unit	Unit Rate	Amount \$	Total Cost \$	Cost/Floor Area \$/ sf	%
A1 SUBSTRUCTURE					176,000	9.36	4.1%
A1.1 Standard Foundations	18,800	sf	5.62	106,000		5.64	
A1.2 Special Foundations	18,800	sf	2.98	56,000		2.98	
A12 Basement Excavation	18,800	sf	0.75	14,000		0.74	
A2 STRUCTURE					493,000	26.22	11.5%
A21 Lowest Floor Construction	18,800	sf	1.09	20,000		1.06	
A22.1 Upper Floor Construction	18,800	sf	17.38	327,000		17.39	
A22.2 Stair Construction	18,800	sf	1.27	24,000		1.28	
A23 Roof Construction	18,800	sf	6.51	122,000		6.49	
A3 EXTERIOR ENCLOSURE					536,000	28.51	12.5%
A31 Structural Walls Below Grade	18,800	sf	2.21	42,000		2.23	
A32.1 Walls Above Grade	18,800	sf	9.13	172,000		9.15	
A32.2 Structural Walls Above Grade	18,800	sf	6.52	123,000		6.54	
A32.3 Curtain Walls	18,800	sf	0.72	14,000		0.74	
A33.1 Windows & Louvres	18,800	sf	2.89	54,000		2.87	
A33.2 Glazed Screens	18,800	sf	0.43	8,000		0.43	
A33.3 Doors	18,800	sf	0.96	18,000		0.96	
A34.1 Roof Covering	18,800	sf	3.75	71,000		3.78	
A34.2 Skylights	18,800	sf	0.42	8,000		0.43	
A35 Projections	18,800	sf	1.39	26,000		1.38	
B1 PARTITIONS & DOORS					160,000	8.51	3.7%
B1.1 Fixed Partitions	18,800	sf	5.59	105,000		5.59	
B1.2 Moveable Partitions	18,800	sf	0.10	2,000		0.11	
B1.3 Structural Partitions	included	sf	0.00	0		0.00	
B12 Doors	18,800	sf	2.82	53,000		2.82	
B2 FINISHES					152,000	8.09	3.5%
B21 Floor Finishes	18,800	sf	3.91	74,000		3.94	
B22 Ceiling Finishes	18,800	sf	2.95	55,000		2.93	
B23 Wall Finishes	18,800	sf	1.22	23,000		1.22	
B3 FITTINGS & EQUIPMENT					442,000	23.51	10.3%
B31.1 Metals	18,800	sf	0.65	12,000		0.64	
B31.2 Millwork	18,800	sf	6.87	129,000		6.86	
B31.3 Specialties	18,800	sf	2.66	50,000		2.66	
B32 Equipment	18,800	sf	1.84	35,000		1.86	
B33.1 Elevators	18,800	sf	8.99	169,000		8.99	
B33.2 Escalators & Moving Walkways	18,800	sf	0.00	0		0.00	
B33.3 Material Handling Systems	18,800	sf	2.51	47,000		2.50	
C1 MECHANICAL					967,000	51.44	22.6%
C11 Plumbing and Drainage	18,800	sf	7.77	146,000		7.77	
C12 Fire Protection	18,800	sf	2.93	55,000		2.93	
C13 HVAC	18,800	sf	31.76	597,000		31.76	
C14 Controls	18,800	sf	8.97	169,000		8.99	
C2 ELECTRICAL					485,000	25.80	11.3%
C21 Service & Distribution	18,800	sf	12.68	238,000		12.66	
C22 Lighting, Devices & Heating	18,800	sf	3.92	74,000		3.94	
C23 Systems & Ancillaries	18,800	sf	9.19	173,000		9.20	
Z1 GENERAL REQUIREMENTS & FEES					341,000	18.14	8.0%
Z11 General Requirements	7.00%			239,000		12.71	
Z12 Fee	3.00%			102,000		5.43	
NET BUILDING COST					\$3,752,000	199.57	87.6%
\$/ BED					\$134,000		