Making Healthcare Safer IV

# Potential Harms Resulting From Patient-Clinician Real-Time Clinical Encounters Using Video-Based Telehealth: A Rapid Evidence Review

*Rapid Review*

## Structured Abstract


**Objectives.** To review the evidence on harms associated with patient-clinician real-time encounters using video-based telehealth and determine the effectiveness of any related patient safety practices (PSPs). PSPs are interventions, strategies, or approaches intended to prevent or mitigate unintended consequences of healthcare delivery and improve patient safety. This review provides information that clinicians and health system leaders need to determine how to minimize harms from increasing real-time use of telehealth.

**Methods.** We followed rapid review processes of the Agency for Healthcare Research and Quality Evidence-based Practice Center Program. We searched PubMed, EMBASE, and Cochrane to identify eligible studies published from 2012 to 2022, supplemented by a search for unpublished evaluations and white papers. Outcomes of interest included: adverse events (any harm to patients due to medical care), other specified harms (i.e., preventable hospitalizations, inappropriate treatment, missed or delayed diagnoses, duplication of services, privacy breaches), and implementation factors for any PSPs.

**Findings.** Our search retrieved 7,155 citations, of which 23 studies (including 6 randomized controlled trials [RCTs]) were eligible for review. Fourteen studies reported on adverse events or unintended effects of telehealth; these studies were conducted in diverse settings, with four studies in behavioral health, two each in rehabilitation, transplant, and Parkinson's care, and one each in postoperative, termination of pregnancy, community health, and hospital-at-home settings. Adverse events such as death, reoperation, infection, or major complications were infrequent in both telehealth and usual care groups, making it difficult to find statistically significant differences. One RCT found telehealth resulted in fewer medication errors than standard care. Thirteen studies examined preventable hospitalizations or emergency department (ED) visits and reported mixed findings; six of these studies were in postoperative care and two were in urological care. Of the 6 RCTs, 3 showed no difference in risk of hospitalization or ED visits for telehealth compared to usual care, and 3 showed reduced risk for patients receiving telehealth. We found no studies on the effectiveness of PSPs in reducing harms associated with real-time telehealth.



Agency for Healthcare Research and Quality
PATIENT SAFETY

**Conclusions.** Studies have evaluated the frequency and severity of harms associated with real-time video-based telehealth encounters between clinicians and patients, examining a variety of patient safety measures. Telehealth was not inferior to usual care in terms of hospitalizations or ED visits. No studies evaluated a specific PSP. More research is needed to improve understanding of harms associated with real-time use of telehealth and how to prevent or mitigate those harms.

# Contents

# 1. Background and Purpose

Telehealth is broadly defined as the use of electronic information and telecommunication technologies to support clinical healthcare, patient and professional health-related education, health administration, and public health.[1] Telehealth comprises an increasingly wide range of tools to support interactions between clinicians and patients. While telehealth services existed in healthcare for decades, the adoption of telehealth increased dramatically since the onset of the Coronavirus disease 2019 (COVID-19) pandemic as a strategy to minimize spread of infection while continuing to care for patients. Reimbursement policies expanded the scope of services that could be conducted via telehealth, a change that benefited patient and workforce safety during the pandemic. Also, major governmental efforts sought to support rapid and safe adoption (telehealth.hhs.gov). While the benefits of telehealth are well established, concerns exist about telehealth, specifically preventable harm due to missed or delayed diagnoses, ineffective communication, and disparities due to technology access. Governmental agencies and professional societies worked diligently to produce guides and resources for rapid adoption and use of telehealth,[2-6] but little evidence existed about any harms associated with telehealth, and what patient safety practices (PSPs) or strategies are most effective in preventing and mitigating identified harms.

Past systematic reviews have concluded that telehealth can be safe and effective for care of orthopedic conditions[7] and cardiovascular disease.[8] An overview of 24 meta-analyses indicated that the use of telehealth did not increase mortality rates across a broad range of care settings.[9] Studies in these meta-analyses cover a wide range of telehealth modalities including m-health, remote monitoring, and asynchronous communication portals and include many international studies. However, concerns about patient safety risks associated with telehealth care remain,[10] particularly in real-time virtual encounters between patients and clinicians. A review and meta-analysis of the effect of telehealth on antibiotic prescribing, was inconclusive due to lack of high-quality research.[11] These real-time interactions via telehealth are becoming more common, but to date the literature about risks for this particular use of telehealth have not been reviewed.

## 1.1 Overview of the Patient Safety Practice

For this rapid review, we define PSPs as interventions, strategies, or approaches intended to prevent or mitigate unintended consequences of the delivery of healthcare and to improve the safety of healthcare for patients.12 We focus specifically on PSPs intended to prevent or mitigate harms associated with use of telehealth in real-time clinical encounters involving two-way live video conferencing between patient and clinician, where clinicians are defined as physicians and other licensed healthcare professionals such as nurses, advanced practice providers, psychologists, social workers, and pharmacists. Examples of PSPs proposed for this purpose include

communication training, precharting (e.g., comprehensive reviews of patient histories), formalized patient escalation strategies, and education and reporting systems for adverse events.

## 1.2 Purpose of the Rapid Review

The purpose of this rapid review is to assess the evidence on the potential harms associated with real-time use of video-based telehealth for encounters between clinicians and patients and determine the effectiveness of any PSPs targeted at reducing identified harms. The review is intended to give clinicians and health system leaders the information needed to minimize harms from increasing real-time use of telehealth. Also, this rapid review summarizes evidence that can help organizations determine how to implement telehealth programs effectively, with attention to strategies for continuously improving the safety and quality of care delivered via telehealth.

## 1.3 Review Questions

1. What is the frequency and severity of harms associated with use of video-based telehealth in real-time clinical encounters between patients and clinicians?
2. What patient safety measures or patient safety indicators have been used to examine the harms associated with use of video-based telehealth in real-time clinical encounters?
3. What PSPs have been used to prevent or mitigate the harms associated with use of video-based telehealth in real-time clinical encounters, and in what settings have they been used?
4. What is the reported rationale for the PSPs that have been used to prevent or mitigate the harms associated with use of video-based telehealth in real-time clinical encounters?
5. What are the effectiveness and unintended effects of the PSPs?
6. What are the most common barriers and facilitators (including cost and staff time) to implementing the PSPs?
7. What toolkits are available to support implementation?

# 2. Methods

We followed processes proposed by the Agency for Healthcare Research and Quality Evidence-based Practice Center Program.[13] The final protocol for this rapid review is posted on the AHRQ website at: https://effectivehealthcare.ahrq.gov/sites/default/files/related_files/patient-safety-practices-rapid-protocol.pdf. The rapid review is intended to provide an assessment of evidence in a compressed timeframe to inform an end-user's decision. While the steps are similar to those of a "typical" systematic review, the methods are different (streamlined systematic review methods).[13]

For this rapid review, strategic adjustments were made to streamline traditional systematic review processes and deliver an evidence product in the allotted time. Adjustments included being as specific as possible about the questions, limiting the number of databases searched, modifying search strategies to focus on finding the most valuable studies (i.e., being flexible on sensitivity to increase the specificity of the search), restricting the search to studies published in English and conducted in the United States, and having each study assessed by a single reviewer who passed extracted data to a second reviewer to check accuracy without independent data extraction. This rapid review did not include a formal risk-of-bias or strength-of-evidence assessment because we did not find any studies of the effectiveness of a specific patient safety practice (PSP).

## 2.1 Eligibility Criteria for Studies of Effectiveness

We searched for original studies on the review questions according to the inclusion and exclusion criteria presented in Table 1. For this rapid review, we define a telehealth visit as a real-time clinical encounter involving two-way live video conferencing between a patient and clinician. Studies were excluded if there was no element of synchronous video communication between a patient and clinician. Studies including multiple telehealth modalities (e.g., text or phone-based interactions, remote-monitoring) were included if live videoconferencing between a patient and clinician was one part of these multicomponent interventions.

Outcomes of interest included three broad categories: adverse events (any study defined harm to patients due to medical care), other specified harms (i.e., preventable hospitalizations, inappropriate treatment, missed or delayed diagnoses, duplication of services, privacy/confidentiality breaches), and implementation barriers and facilitators for any identified PSPs.

**Table 1. Inclusion and exclusion criteria**

| Study Parameter | Inclusion Criteria | Exclusion Criteria |
|---|---|---|
| **Population** | Adults receiving clinical care for acute or chronic conditions or health maintenance issues (i.e., preventive care) from a nonclinical site (e.g., home setting) using telehealth to enable a real-time clinical encounter involving two-way live video conferencing between patient and clinician. | • Children (age < 18 years) and caregivers for children<br>• Adults receiving inpatient or emergency department care<br>• No element of synchronous video communication (remotely delivered, nonsynchronous medical services, such as remote monitoring, messaging, and email)<br>• Use of mobile health apps without a two-way live video encounter<br>• Audio-only visits<br>• Interactions between clinicians without real-time inclusion of a patient<br>• Computerized decision support without an interaction between a patient and a clinician<br>• Systems that provide only automated, computer-driven feedback in response to patient self-monitoring data |
| **Intervention** | PSPs to prevent or mitigate patient harms associated with use of video-based telehealth in real-time clinical encounters between patients and clinicians, such as adverse events, misdiagnosis, inappropriate treatment, loss of privacy, or duplication of services. | Interventions focusing exclusively on providing access to telehealth. |
| **Comparator** | • Usual care without PSP<br>• Care involving a different PSP | No clear description of intervention and comparator. |
| **Outcome** | • Adverse events<br>  ○ Any study-defined harm to patients caused by medical care<br>• Other harms<br>  ○ Preventable hospitalization<br>  ○ Inappropriate treatment<br>  ○ Misdiagnosis or delayed diagnosis<br>  ○ Delayed care<br>  ○ Duplication of services (telehealth followed immediately by an in-person visit)<br>  ○ Privacy/confidentiality breaches<br>• Implementation barriers and facilitators, including characteristics and resource needs related to:<br>  ○ The intervention (PSP), including time and cost<br>  ○ Outer setting—factors external to the healthcare organization such as regulatory requirements and financial pressures<br>  ○ Inner setting—characteristics of the local context where the PSP is implemented.<br>  ○ Individuals involved<br>  ○ Process | No outcome of interest. |
| **Timing** | • Published 2012 to September 2022 | Published before 2012 |

| Study Parameter | Inclusion Criteria | Exclusion Criteria |
|---|---|---|
| **Setting** | • Clinical practices and healthcare systems in the United States | • No clinical site in the United States<br>• US healthcare included with other systems without data segregation by country |
| **Type of studies** | • **For Questions 1–4 and 6–7**, include any study with original quantitative or qualitative data<br>• **For Question 5**, include randomized controlled trials, nonrandomized controlled trials, and observational studies with a comparison group | **For Questions 1–4 and 6–7:**<br>• No original data<br><br>**For Question 5:**<br>• No original data<br>• No original data or no comparison group |

PSP = patient safety practice

## 2.2 Literature Searches for Studies of Effectiveness

We searched PubMed, EMBASE, and Cochrane, supplemented by a narrowly focused grey literature search for unpublished evaluations and white papers that were publicly available from governmental agencies or professional societies. These agencies or societies included the American Medical Association, the American Telemedicine Association, the Office of the National Coordinator, the Patient Safety Learning hub (pslhub.org), and the World Health Organization's Global Patient Safety Network. We also checked ClinicalTrials.gov and PROSPERO for relevant unpublished work. For details of the search strategy, see Appendix A methods tables A-1 through A-3.

## 2.3 Data Extraction (Selecting and Coding)

The title and abstract of each citation were screened by a single team member. A second team member independently checked a 10 percent sample of citations to verify that important studies were not excluded after the review of titles and abstracts. The full text of each remaining potentially eligible article was reviewed by a single team member to confirm eligibility and extract data. A second team member checked a 10 percent sample of the full-text reviews to verify that important studies were not excluded and confirm the accuracy of extracted data.

For all articles, reviewers extracted any available information on general study characteristics (e.g., author, year, study design), characteristics of the patient safety practice, rationale for the patient safety practice, outcomes, and implementation barriers and facilitators.

## 2.4 Risk of Bias (Quality) Assessment

We planned to assess the risk of bias of studies on the effectiveness of relevant patient safety practices, but no such assessment was performed because we did not find any effectiveness studies.

# 3. Evidence Summary

## 3.1 Benefits and Harms

For this review, we define patient safety practices (PSPs) as interventions, strategies, or approaches intended to prevent or mitigate unintended consequences of the delivery of healthcare and to improve the safety of healthcare for patients.[12] We focused on telehealth in real-time clinical encounters involving two-way live video conferencing between a patient and clinician.

- This rapid review identified no specific interventions that could be characterized as a replicable PSP for addressing potential safety risks in real-time, synchronous video-based telehealth encounters between clinicians and patients in the United States.
- The majority of studies on the topic were limited to evaluation of the frequency and severity of harms associated with real-time video-based telehealth encounters between clinicians and patients, examining a variety of patient safety measures and indicators.
- Fourteen studies reported on adverse events or unintended effects of real-time use of video-based telehealth. Adverse events such as death, surgery, infection, or major complications were infrequent with telehealth or usual care, making it difficult to find statistically significant differences. Medication errors were the exception, with one study showing that a focused telehealth intervention resulted in *fewer* medication errors than standard in-person care.[14]
- Thirteen studies addressed preventable hospitalizations or emergency department (ED) visits as an outcome associated with the use of video-based telehealth in real-time clinical encounters between patients and clinicians. These studies reported mixed findings. Of the six randomized controlled trials (RCTs), three showed no difference in risk of hospitalization or ED visits for telehealth compared to usual care, and three showed reduced risk for patients receiving telehealth.

## 3.2 Future Research Needs

- More research is needed to improve understanding of specific harms associated with real-time use of telehealth and how to prevent or mitigate those harms.

# 4. Evidence Base

## 4.1 Number of Studies

Our search retrieved 7,155 unique titles and abstracts from which we reviewed 268 full text articles for eligibility (Figure 1). We only found 23 studies that met our eligibility criteria, including 14 studies on Questions 1 and 2 that addressed adverse events or unintended effects, 13 studies on Questions 1 and 2 that addressed preventable hospitalizations, and 1 study on Questions 1 and 2 that addressed misdiagnosis or delayed diagnosis. We did not find any studies that addressed Questions 3–7. A listing of studies excluded during full-text review is included in Appendix B, List of Excluded Studies, and information abstracted from each included study is provided in Appendix C, Evidence Tables. Figure 2 presents the publication year of the included studies.

**Figure 1. Results of the search and screening**

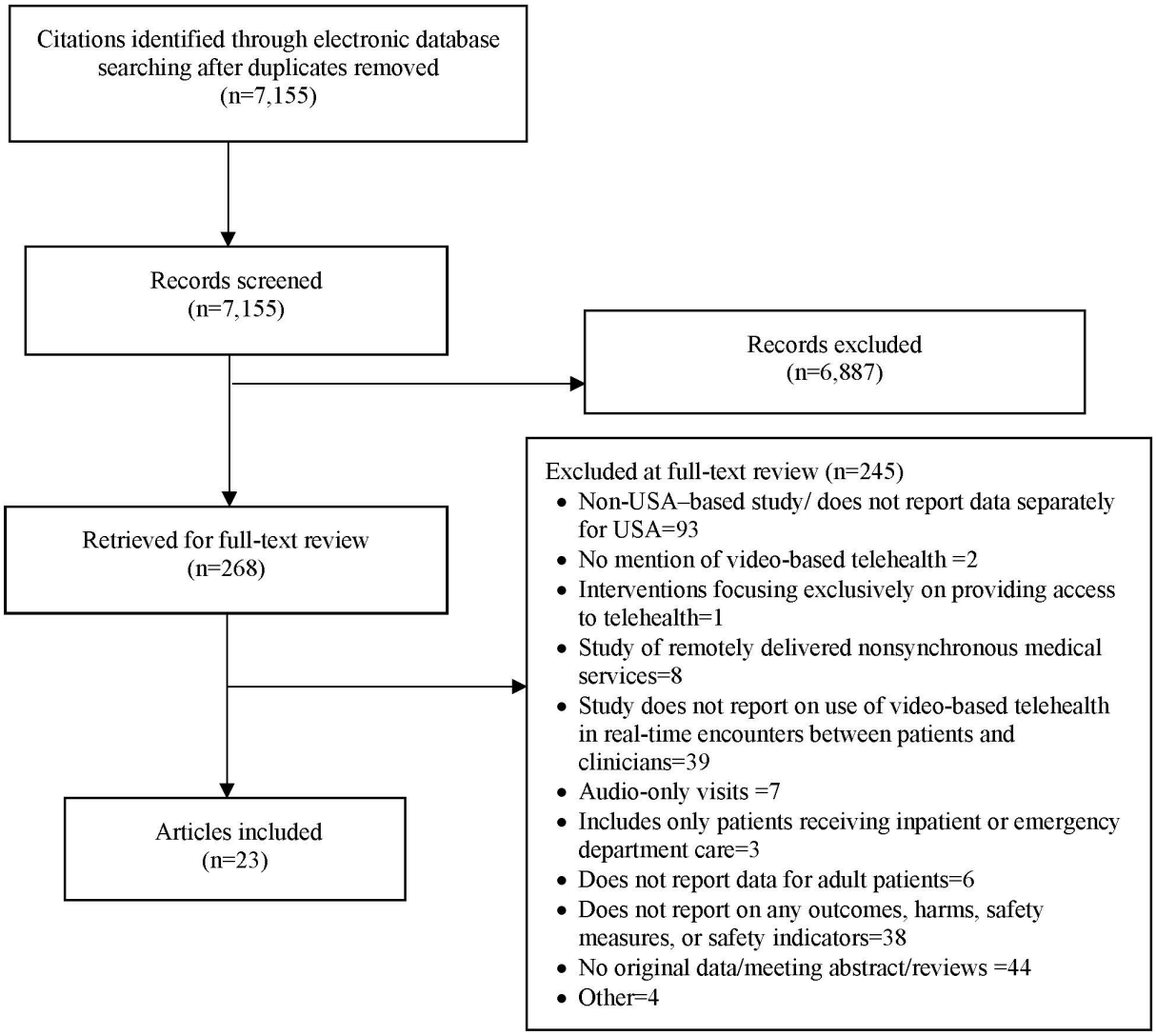
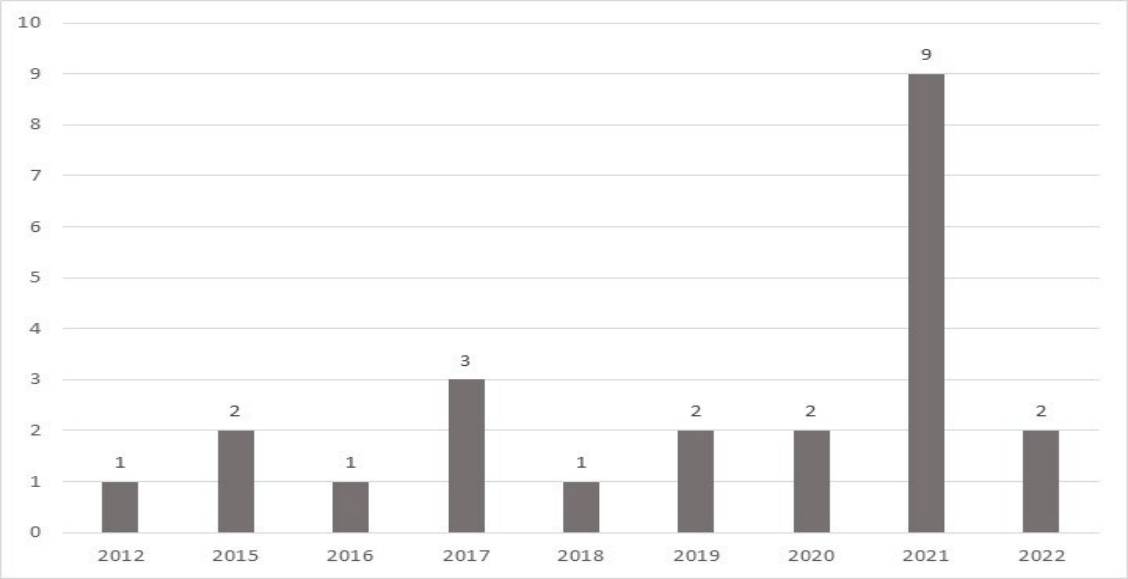


**Figure 2. Number of included studies by year of publication**




## 4.2 Findings for Review Questions

### 4.2.1 Question 1. What is the frequency and severity of harms associated with use of video-based telehealth in real-time clinical encounters between patients and clinicians?

### Question 2. What patient safety measures or patient safety indicators have been used to examine the harms associated with use of video-based telehealth in real-time clinical encounters?

Questions 1 and 2 are tightly coupled, and therefore we present the findings together. Question 1 addresses any potential harms related to use of video-based telehealth, and Question 2 more narrowly addresses any standard measures for these harms that could be used by different stakeholders to understand, track, and reduce risk of harm. We present the outcomes by type of care delivery. The findings are summarized in Tables 2 and 3.

- Adverse events such as death, surgery, infection, or major complications were infrequent with telehealth or usual care, making it difficult to find statistically significant differences. Medication errors were the exception, with one study showing that a focused telehealth intervention resulted in *fewer* medication errors than standard in-person care.[14]

- Studies reported mixed findings on preventable hospitalizations or emergency department (ED) visits.

#### 4.2.1.1 Adverse Events/Unintended Effects

A total of 14 studies reported information about adverse events or unintended effects of using video-based telehealth in real-time encounters between patients and clinicians.[14-27] These studies examined diverse types of care delivery, with four studies conducted in behavioral health: two each in rehabilitation, transplant, and Parkinson's care, and one each in postoperative, termination of pregnancy care, community health (e.g., using nonclinical means to improve health), and hospital-at-home services (Table 2). Details of this study can be found in Appendix C, Evidence Tables C-1 through C-5. Some of these studies used an active surveillance system to detect rates of targeted harms (e.g., pressure ulcers, infections, medication errors, falls), and others reported a broad category of adverse events. Table 2 describes the variety of adverse events reported across these studies.

##### 4.2.1.1.1 Telehealth in Behavioral Health Care

Four studies reported adverse event outcomes for video-based telehealth in behavioral healthcare. A small feasibility and safety study focused on 10 active-duty members of the U.S. military receiving behavioral health treatment for posttraumatic stress and reported no adverse events, defined as psychiatric hospitalizations, suicides, and nonfatal suicide-related behaviors, number of times the patient support person was used during treatment, treatment adherence, and frequency of requests for patient or therapist technical support.[23] Following this safety study, a randomized controlled trial (RCT) compared telehealth or in-person delivery of behavioral activation treatment for depression with active-duty military personnel or veterans recruited from a military treatment facility and a Veterans Health Administration hospital.[24] Seven of 40 (17.5%) participants in the telehealth condition and 4 of 42 (9.5%) in the standard care condition experienced adverse events. None of these events (e.g., exacerbation of asthma) were determined to be related to the study.

Another small safety and feasibility study examined medication-augmented exposure therapy for posttraumatic stress in 11 participants from high-risk occupations and reported no safety events.[26] Seven of the 11 participants completed 12 to 15 sessions.

A randomized controlled feasibility study of mental health consultations for patients with depression or anxiety delivered through in-person or telehealth reported that 4 (of 22) participants in the telehealth condition reported at least 1 unintended consequence or adverse effect attributable to the telehealth intervention.[27] However, no adverse events were categorized as

serious, and data was not reported for the 27 participants in the usual care group.

All studies of video-based telehealth in behavioral health were small. Only one of the four studies provided a comparison of adverse events in telehealth and in-person care.

#### 4.2.1.1.2 Telehealth in Rehabilitation

Two studies reported outcomes for video-based telehealth use in rehabilitation, one in followup after discharge from an intensive care unit (ICU) and one in cardiac rehabilitation. A small single-site randomized feasibility study focused on 21 medical/surgical ICU survivors with cognitive or functional impairment at hospital discharge and compared in-person to telehealth rehabilitation over a three-month period.[19] Patients discharged to a nursing home or rehabilitation center were excluded from the study. One of the 13 participants in the telehealth group experienced an adverse event (i.e., a minor ankle sprain while conducting a walking exercise), while no patients receiving standard care did.

A second small RCT compared standard cardiac rehabilitation (21 participants) to hybrid care involving both in-person and telehealth care (26 participants).[21] It reported no adverse events, including falls requiring hospitalization within 3 hours of completing a session, for either group.

While both studies in rehabilitation are small, each study provided comparisons between telehealth and in-person care.

#### 4.2.1.1.3 Telehealth in Transplant Care

Two studies reported outcomes for video-based telehealth in transplant care, one applying telehealth to the evaluation and listing of patients for transplant and the other to post-transplant medication management. A retrospective study of 465 patients at one Veteran's Affairs Medical Center compared pretransplant mortality between those evaluated for liver transplant either in person (n = 233) or through telehealth (n = 232) and found no significant difference.[20]

An RCT involved 136 kidney transplant recipients randomized to either usual care or a telehealth intervention including a mobile health app, remote monitoring of blood pressure and glucose, and video-based telehealth visits with a pharmacist.[14] The total number of medication errors were significantly higher in the usual care control arm (1,385 versus 614, incident risk ratio 0.39, confidence interval 0.28 to 0.55, $p<0.001$). No significant differences were observed for rates of total infection or opportunistic infection. These studies suggest that telehealth may be no different than usual care in infections experienced by patients, and telehealth could reduce errors in post-transplant medication management compared to usual care.

#### 4.2.1.1.4 Telehealth in Parkinson's Disease Care

Two studies reported adverse event outcomes in Parkinson's disease care involving use of video-based telehealth. One feasibility study of a virtual fall risk assessment involved 15 patients with Parkinson's disease and reported no adverse events.[15] A feasibility study of multidisciplinary care from speech therapists, physiotherapists, and pharmacists focused on 15 patients with Parkinson's disease over 8 weeks and similarly reported no adverse events.[18] Speech therapy, physiotherapy, and medication management sessions were delivered and supervised in real time by video telehealth.

Neither of these studies provided a comparison group, and both were small. Drawing conclusions about low-frequency adverse events is not appropriate.

#### 4.2.1.1.5 Telehealth in Postoperative Care

A prospective cohort study included 718 surgical Veterans Affairs patients that self-selected video-based telehealth or traditional in-person care for post-operative followups. [25] The study reported no adverse events, including no significant differences in readmission or ED visits between the two groups.

#### 4.2.1.1.6 Telehealth in Termination of Pregnancy Care

A retrospective study of 19,170 patients receiving termination of pregnancy care included 8,765 video-based telehealth visits and 10,405 in-person visits resulting in medical termination of pregnancy.[17] Noninferiority for telehealth medical termination of pregnancy was confirmed with no significant difference in patients receiving a transfusion and no cases of death or surgery in either group.

#### 4.2.1.1.7 Telehealth and Community Health Setting

One prospective cohort study of 13 men examined adverse events for video-based telehealth applied in the community health setting. A novel model of hypertension care, in which barbers refer men to hypertension care by pharmacists who use telehealth, reported no adverse events.[16]

#### 4.2.1.1.8 Telehealth in Hospital-at-Home Care

One study examined adverse events associated with video-based telehealth in hospital care provided at home. An RCT compared adverse events in daily, in-home physician visits to initial in-home physician visits followed by subsequent video visits facilitated by an in-home nurse.[22] A total of 172 patients were randomized, 84 to receive remote care and 88 in-home physician care. Adverse events included falls, pressure injury, and delirium,

with comparable rates suggesting noninferiority of telehealth care to in-person in-home care.

**Table 2. Summary of studies reporting adverse events associated with video-based telehealth**

| Type of Care Delivery | Author, Year<br><br>Design | Study Participants | N | Telehealth Intervention* | Measures | Study Results |
|---|---|---|---|---|---|---|
| Telehealth in behavioral care | Luxton, 2015[23]<br><br>Feasibility study | Enlisted members of U.S. Army with PTSD | 8 | A behavioral activation treatment for PTSD delivered via synchronous (two-way) videoconferencing to the homes of U.S. military service members | Psychiatric hospitalizations, suicides, nonfatal suicide-related behaviors, patient support utilization, frequency of support requests, and treatment adherence | No adverse events reported |
| | Tönnies, 2021[27]<br><br>RCT | Patients with depression or anxiety disorder | 49<br><br>Control N=27<br><br>Intervention N=22 | Web-based, real-time video consultations involving a 2-way interactive video to a primary care practice between mental health specialists and patients for up to 5 sessions | Self-reports of treatment leading to feeling worse, feeling hurt, fear of discovery of therapy | No serious major adverse events were reported although 4 of 22 patients in the treatment arm self-reported an unintended consequence or adverse event not otherwise serious. Adverse events were not reported for the control arm. |
| | Luxton, 2016[24]<br><br>RCT | U.S. military personnel | 121<br><br>Control N=59<br><br>Intervention N=62 | 8 sessions of behavioral activation treatment for depression in home via videoconferencing | Adverse events unrelated to treatment not defined except asthma attack. One safety protocol triggered by a previously unreported suicidal ideation. | No adverse events reported |
| | Olden, 2017[26]<br><br>Prospective cohort | Survivors of trauma resulting from working in an occupation at risk for post-traumatic stress disorder | 7 | 12–15 session exposure therapy protocol conducted weekly in 1.5-hour sessions through videoconferencing | None | No adverse events reported |

| Type of Care Delivery | Author, Year<br><br>Design | Study Participants | N | Telehealth Intervention* | Measures | Study Results |
|---|---|---|---|---|---|---|
| Telehealth in rehabilitation | Jackson, 2012[19]<br><br>RCT | Patients discharged from medical intensive care unit or surgical intensive care unit | 15<br><br>Control N=8<br><br>Intervention N=7 | The rehabilitation intervention was provided over a 12-week period post-discharge in each patient's home and integrated both traditional "face-to-face" interventions as well as novel telephonic and video-based interventions | None | 1 adverse event reported, an ankle sprain during walking exercise therapy. No adverse events were reported for the control arm. |
| | Keteyian, 2021[21]<br><br>RCT | Cardiac rehabilitation patients | 47<br><br>Control N=21<br><br>Intervention N=26 | Sessions completed remotely at-home or in the community using telehealth. | Falls requiring hospitalization | No serious adverse event or falls reported |
| Telehealth in Transplant care | John, 2020[20]<br><br>Retrospective cohort | Liver transplant candidates | 465<br><br>Control N=233<br><br>Intervention N=232 | Telehealth visits with transplant hepatologist | Pre transplant mortality | No adverse events reported, no difference in pre-transplant mortality |
| | Gonzales, 2021[14]<br><br>RCT | Kidney transplant patients | 136<br><br>Control N=68<br><br>Intervention N=68 | Clinical pharmacist–led supplemental medication therapy monitoring and management, with risk-driven televisit and home-based blood pressure and blood glucose monitoring. | Medication error, total infection, and opportunistic infection rate | The total number of medication errors were significantly higher in the control arm. No significant differences were observed for other adverse events of total infection or opportunistic infection. |

| Type of Care Delivery | Author, Year<br><br>Design | Study Participants | N | Telehealth Intervention* | Measures | Study Results |
|---|---|---|---|---|---|---|
| Telehealth in Parkinson's care | Afshari, 2021[15]<br><br>Feasibility study | Patients with Parkinson's disease | 15 | Four televisits every 2 weeks; televisits were performed on a HIPAA compliant secure video connect Epic platform. | Falls, near falls, and care partner intervention | No adverse events reported |
| | Hidecker, 2022[18]<br><br>Prospective cohort | Patients with Parkinson's disease | 13 | 8-week telehealth program, consisting of speech therapy, physiotherapy, and pharmaceutical care | Falls, cardiac events, injuries, self-reported discomfort caused by therapy | No serious adverse events reported,<br>8 speech therapy patient reported hoarse voice of throat pain,<br>2 physiotherapy patients reported muscle soreness |
| Telehealth in postoperative care | Nikolian, 2018[25]<br><br>Prospective cohort | Postoperative patients | 718<br><br>Control N=485<br><br>Intervention N=233 | 2-week postoperative visit was conducted using telehealth (video). | None | No adverse events reported |
| Telehealth in termination of pregnancy care | Grossman, 2017[17]<br><br>Retrospective cohort | Pregnant women | 19,170<br><br>Control N=10,405<br><br>Intervention N=8,765 | Video discussion with patients, and if eligible for a medical termination of pregnancy, mifepristone and misoprostol were remotely prescribed | Hospital admission, surgery, blood transfusion, death, emergency department intravenous fluids or oral medication | No significant difference in adverse events for transfusion, no cases of death or surgery in either group |
| Telehealth and community health setting | Blyler, 2021[16]<br><br>Prospective cohort | Black men with stage 2 hypertension (systolic blood pressure ≥140 mm Hg) | 13 | Monthly virtual visits, connecting with the pharmacist via WebEx, Facetime, or standalone blood pressure monitors housed in the barbershops | Adverse events undefined | No adverse events reported |

| Type of Care Delivery | Author, Year<br><br>Design | Study Participants | N | Telehealth Intervention* | Measures | Study Results |
|---|---|---|---|---|---|---|
| Telehealth in hospital-at-home care | Levine, 2022[22]<br><br>RCT | Patients who are home-health subscribers | 172<br><br>Control N=88<br><br>Intervention N=84 | Video visit daily after initial in-home visit (physician had option to see the patient in home again as needed) | Fall, pressure injury, delirium, thromboembolism, thrombophlebitis, catheter-associated urinary tract infection, new *Clostridoides difficile* infection, new methicillin-resistant *Staphylococcus aurus* infection, new arrhythmia, hypokalemia, acute kidney injury, transfer to hospital, unplanned mortality during or 30 days after admission | Adverse events included fall, pressure injury and delirium. Mean adjusted adverse events were 6.8 per 100 patients in the remote care arm and 3.9 per 100 patients in the control arm (difference reported as being within the range supporting noninferiority) |

HIPAA = Health Insurance Portability and Accountability Act; PTSD =posttraumatic stress disorder, N= number of participants; RCT = randomized controlled trial
*As reported in the included studies

#### 4.2.1.2 Preventable Hospitalizations or Emergency Department Visits

A total of 13 studies addressed preventable hospitalizations or emergency department (ED) visits as an outcome associated with use of video-based telehealth in real-time clinical encounters between patients and clinicians. Seven of the studies reported on both outcomes,[14, 17, 25, 28-31] three studies reported solely on preventable hospitalizations,[32-34] and three studies reported on ED visits only.[22, 35, 36] Table 3 provides a summary of findings for these studies. Details can also be found in Appendix C, Evidence Tables C-1 through C-3, and C-6 and C-7.

##### 4.2.1.2.1 Telehealth in Postoperative Care

Six of the 13 studies focused on the use of video-based telehealth in postoperative care for a variety of surgical procedures including transplants (Table 3).

A small RCT of 30 patients in an enhanced recovery after surgery (ERAS) program (including postoperative telehealth) showed that 2 of 14 patients in the telehealth program were rehospitalized compared to none of 16 in usual care.[28] Also, 2 of 14 patients in the telehealth program had an ED visit compared to 1 of 14 patients receiving usual care. Significance was not reported for hospitalization or ED visit outcomes. The study was small, and the intervention included other components such as accelerated discharge which may have impacted rehospitalization rates in the telehealth program.

Another RCT randomized 136 kidney transplant recipients to usual care or a telehealth intervention including a mobile health app, remote monitoring of blood pressure and blood glucose, and telehealth visits with a pharmacist.[14] The trial showed a significantly lower rate of hospitalizations for patients receiving the telehealth bundle.[14] A nonrandomized study of 341 thoracic surgery patients showed that patients opting out of a telehealth followup visit had increased ED visits (odds ratio (OR) 8.7, $p <= 0.05$) and 30-day readmissions (OR 5.1, $p <= 0.05$) compared to patients opting for telehealth care.[30]

One study assessed the impact of a range of practice changes to adapt liver transplantation services during the pandemic, including postoperative telehealth followup visits.[34] That study showed a trend toward increased readmission rates for patients receiving the redesigned care bundle during the pandemic (41.9% prepandemic versus 61.5% of peripandemic patients, $p = 0.09$). The study was small, and the intervention had multiple components.[34] The authors did not directly speculate on the causes of increased readmissions but described the complex effects of the pandemic on transplantation including decreases in referrals and delays in patient listings resulting in a likely increase in disease progression of patients receiving transplants during the pandemic.

A prospective cohort study of 718 surgical Veterans Affairs system patients showed no significant differences in postoperative readmissions or ED visits between standard of care and a postoperative intervention including telehealth.[25]

Lastly, a randomized noninferiority trial for postdischarge virtual visits after low-risk surgeries showed that virtual followups were noninferior to in-person care for readmissions.[32] Thus, postoperative interventions involving telehealth care were associated with varying differences in readmissions or ED visits compared with usual care.

#### 4.2.1.2.2 Telehealth in Urological Care

Two studies examined the use of video-based telehealth in urological care. In a retrospective study of a telehealth program in male prisoners in Iowa, no patients required ED visits.[36] In a retrospective study of a telehealth program in the Veterans Affairs system, 1 percent of patients (1 of 97) had an ED visit within 30 days after the telehealth encounter.[35] It is difficult to draw conclusions from these two studies because they did not have a comparison group.

#### 4.2.1.2.3 Telehealth in Hospital Discharge

In a RCT of 102 patients being discharged from the hospital, there were no significant differences in ED visits or readmissions between a tele-

discharge program (including virtual visits and telemonitoring) and standard in-person care after controlling for age, gender, and number of diagnoses.[29] The authors reported that the study was underpowered to statistically evaluate hospital admissions and ED visits.

#### 4.2.1.2.4 Telehealth in Palliative Care

One quality improvement study integrated pharmacists into an interprofessional palliative care team in a single Veterans Affairs medical center and tracked ED visits and hospital admissions, but it did not report any comparative data between their video and telephone groups.[31]

#### 4.2.1.2.5 Telehealth in Termination of Pregnancy Care

In a retrospective study of 19,170 patients receiving termination of pregnancy care, there was no significant difference in ED visits or hospitalizations between video-based telehealth or in person care.[17] Six of 8,765 telehealth patients (0.07%) experienced a hospitalization compared to 13 of 10,405 in-person patients (0.12%). Thirteen telehealth patients (0.15%) experienced an ED admission with treatment compared to 22 in-person patients (0.21%).

#### 4.2.1.2.6 Telehealth for Hospital-Level Care at Home

In an RCT of 172 patients receiving hospital-level care at home, 3.6 percent of patients randomized to remote video-based physician care were transferred back to the hospital compared with 2.3 percent of patients receiving in-person physician care.[22]

#### 4.2.1.2.7 Telehealth in Burn Care

In a retrospective study of 52 patients receiving video-based telehealth followup burn care, no readmissions were reported.[33]

**Table 3. Summary of preventable hospitalizations or emergency department visits associated with video-based telehealth**

| Type of Care Delivery | Author, Year Study Design | Study Participants | N | Telehealth Intervention* | Measures | Study Results |
|---|---|---|---|---|---|---|
| Telehealth in postoperative care | Bednarski, 2019[28]<br><br>RCT | Colonic or rectal cancer patients | 30<br><br>Control N=16<br><br>Intervention N=14 | Accelerated discharge with televideo conference on the second postoperative day with a physician assistant. | Readmissions and ED visits within 30 days of surgery were monitored according to the Clavien–Dindo classification. | Telehealth was associated with a small increased rate of readmissions and ED visits compared to usual care that |

| Type of Care Delivery | Author, Year Study Design | Study Participants | N | Telehealth Intervention* | Measures | Study Results |
|---|---|---|---|---|---|---|
| | | | | | | was not statistically significant. |
| | Gonzales, 2021[14]<br><br>RCT | Kidney transplant patients | 136<br><br>Control N=68<br><br>Intervention N=68 | Clinical pharmacist led supplemental medication therapy monitoring and management, with risk-driven televisits and home-based blood pressure and blood glucose monitoring. | Hospitalizations were defined as admission to a hospital with at least one overnight stay | Telehealth was associated with reduced readmissions. |
| | Tham, 2021[30]<br><br>Retrospective cohort | Thoracic surgery patients | 341<br><br>Control N=46<br><br>Intervention N=295 | Postoperative telehealth visits. | ED visit and readmission within 30 days post discharge | Telehealth was associated with reduced risk for readmissions and ED visits. |
| | Delman, 2021[34]<br><br>Prospective cohort | Transplant waitlisted patients | 344<br><br>Control N=274<br><br>Intervention N=70 | Virtual selection meetings and telehealth follow-up. | Readmission within 30 days post-transplant and Indications for readmission | Telehealth was associated with increased risk for readmissions. |
| | Nikolian, 2018[25]<br><br>Prospective cohort | Post-operative patients | 718<br><br>Control N=485<br><br>Intervention N=233 | 2-week post-operative visit was conducted using telehealth (video). | Length of stay, readmission, reoperation, and ED visits and deaths within 30 days of surgery | Telehealth was no different than usual care in readmissions and ED visits. |
| | Harkey†, 2021[32]<br><br>RCT | Postoperative patients | 236<br><br>Control N=101<br><br>Intervention N=135 | Video-based visits with a certified medical assistant & video-based virtual visits with a surgeon | Patients were emailed a survey 30 days after surgery to assess for adverse events, including readmission to other facilities. Electronic reminders were sent if surveys were not returned within a week, and 2 attempts were made to contact the patient by telephone | Virtual followups were noninferior to in person care for readmissions |

| Type of Care Delivery | Author, Year Study Design | Study Participants | N | Telehealth Intervention* | Measures | Study Results |
|---|---|---|---|---|---|---|
| Telehealth in urological care | Sherwood, 2019[36]<br><br>Retrospective cohort | Prisoners with urologic complaints/ conditions | 376 | Video-based visit with a urological advance practice provider | Safety was assessed by analyzing the number of patients in which an ED visit was required after telehealth visit and missed or delayed cases of malignancy | No ED visits were reported for telehealth, but there was no comparison group |
| | Chu, 2015[35]<br><br>Retrospective cohort | Veterans | 97 | Conducted telemedicine visits 9 half-days per month via a videoconferencing system over a virtual local area network between tertiary medical center and 2 outpatient primary care clinics | Examined the urologic conditions, patient satisfaction, and emergency department visits within 30 days of the telehealth visit | 1% of patients (1 of 97) had an ED visit within 30 days post telehealth encounter, but there was no comparison group |
| Telehealth in hospital discharge | Noel, 2020[29]<br><br>RCT | Patients with two or more chronic conditions | 102<br><br>Control N=57<br><br>Intervention N=45 | Provision of a telehealth kit; telehealth patients measured their vitals daily using the tele-equipment and had weekly virtual visits with a transition of care physician (i.e., teledoc) | Hospital readmissions and emergency department visits within 30 days of the index hospitalization discharge | No difference in ED visits or readmissions between a tele-discharge program (including virtual visits and tele monitoring) and standard in-person care |
| Telehealth in palliative care | Shirley, 2021[31]<br><br>Quality improvement | Veterans with cancer | 25 | Pharmacist-integrated telemedicine palliative care team clinic to optimize prescribing practices for Veterans receiving palliative care services | Emergency department visits and hospitalizations data was collected for the 6 months following clinic visits | No comparison group, but the average number of ED visits after telehealth visits was 0.16, and the number of hospitalizations for the same time period was 0.36 |
| Telehealth in termination of pregnancy care | Grossman, 2017[17]<br><br>Retrospective cohort | Pregnant women | 19,170<br><br>Control N=10,405<br><br>Intervention N=8,765 | Video discussion with patients, and if eligible for a medical termination of pregnancy, mifepristone and misoprostol are | Assessed whether a patient required hospitalization, surgery, blood transfusion, or treatment in the emergency department | No significant difference in ED visits or hospitalizations between telehealth and in-person care |

| Type of Care Delivery | Author, Year Study Design | Study Participants | N | Telehealth Intervention* | Measures | Study Results |
|---|---|---|---|---|---|---|
| | | | | remotely dispensed | | |
| Telehealth in hospital at home care | Levine, 2022[22]<br><br>RCT | Patients who are home-health subscribers | 172<br><br>Control N=88<br><br>Intervention N=84 | Video visit daily after initial in-home visit (physician had option to see the patient in home again as needed) | Readmission 30-days after discharge from an acute care episode; additionally measured ED visit (unrelated to readmission) within 30 days or a primary care visit within 14 days | No significant difference in readmission rates between telehealth and in-person care |
| Telehealth in burn care | Hickey, 2017[33]<br><br>Retrospective cohort | Burn Victims | 31 | Problem focused video-directed virtual physical exam | No specific definition for readmission | No comparison group, but no readmissions were reported |

ED = emergency departments, N= number of participants; RCT = randomized controlled trial
* As reported in the included studies
† Harkey, 2021[32] included 432 participants in the trial, but only 236 participants completed the allocated intervention. This report used the rate from the participants who completed the allocated intervention.

#### 4.2.1.3 Misdiagnosis or Delayed Diagnosis

One study reported on diagnostic safety in telehealth. A retrospective comparison of diagnostic accuracy in video-based telehealth versus in-person care in 276 unique and 154 repeat telehealth visits showed 90 percent diagnostic concordance.[36] This study reviewed the safety and effectiveness of a urologic telehealth program in the Iowa prisoner population for over a decade. While no adverse events were reported, the results indicated that telehealth visits eliminated the need for in-person care in most cases. Details on this study can also be found in Appendix C, Evidence Tables C-1 through C-3, and C-8.

#### 4.2.1.4 Results From the Grey Literature

This grey literature search focused on patient safety and adverse events in respect to the use of video-based telehealth technologies in delivering healthcare services. We identified seven reports from four sources relevant to this rapid review.[37-43] The findings from these reports suggest that although telehealth has the potential to create operational efficiencies, there remains work to be done in standardizing protocols and procedures for conducting televisits and telehealth encounters. The authors proposed implementation strategies that include educational material for identifying patient safety concerns and developing standards for conducting telehealth encounters. We did not find any eligible

unpublished studies or work by searching ClinicalTrials.gov and PROSPERO. Appendix D provides details of the results of the grey literature searches.

### 4.2.2 Question 3. What PSPs have been used to prevent or mitigate the harms associated with use of video-based telehealth in real-time clinical encounters, and in what settings have they been used?

No studies met our inclusion criteria for this question.

### 4.2.3 Question 4. What is the reported rationale for the PSPs that have been used to prevent or mitigate the harms associated with use of video-based telehealth in real-time clinical encounters?

No studies met our inclusion criteria for this question.

### 4.2.4 Question 5. What are the effectiveness and unintended effects of the PSPs?

No studies met our inclusion criteria for this question.

### 4.2.5 Question 6. What are the most common barriers and facilitators (including cost and staff time) to implementing the PSPs?

No studies met our inclusion criteria for this question.

### 4.2.6 Question 7. What toolkits are available to support implementation?

No publicly available tools were found.

# 5. Discussion

## 5.1 Summary and Interpretation of Findings

This rapid review synthesized the literature evaluating patient safety issues and practices associated with real-time, synchronous video-based encounters between clinicians and patients. This is the first review to focus on patient-clinician real-time clinical encounters using video-based telehealth. The studies were systematically examined for questions about the safety of telehealth including any reporting of: the frequency and severity of harm, the usage of patient safety measures or indicators to examine harm, what safety practices and settings were used to prevent or mitigate harm, what was the rationale for their usage, the effectiveness and unintended effects of the of patient safety practices (PSPs), common barriers and facilitators to implementation, and any toolkits to support implementation. The majority of included studies were limited to evaluation of the frequency and severity of harm, using a variety of patient safety measures and indicators.

### 5.1.1 The Frequency, Severity, and Measurement of Harms Associated with Use of Telehealth

The most frequently reported patient safety outcomes in the identified studies were either adverse events or healthcare utilization (i.e., preventable hospital admissions, emergency department [ED] visits). Study size and quality varied greatly, with only 9 studies (of 23) identified as randomized controlled trials (RCTs).

Most other adverse events such as death, surgery, infection, or major complications were few, making it difficult to find statistically significant differences. Medication errors were the exception[14] with a focused telehealth intervention resulting in *fewer* medication errors *than* standard in-person care. Additionally, one retrospective study in a prisoner population showed a relatively high level of concordance (90%) between telehealth and in-person diagnoses in urologic care.[36] This is particularly notable as missed or delayed diagnoses are considered one of the more likely harms associated with telehealth use.

The largest group of studies reporting utilization outcomes were in postoperative care. Three randomized controlled trials (RCTs) indicated either reduced risk[14, 28] or no difference in risk[32] of 30-day readmissions. Three cohort studies had mixed results with one study showing reduced risk of readmission and ED visits,[30], one showing no difference with usual care for readmissions and ED visits,[25] and one showing increased risk of readmissions.[34] An RCT of telemedicine in hospital discharge showed no difference in risk of readmissions or ED visits between telehealth and care as usual.[29] An RCT in hospital-at-home care showed no significant difference in readmissions between in-person and telehealth visits with a

doctor.[22] A retrospective cohort study in termination of pregnancy care showed no significant difference in hospital admissions or ED visits between telehealth and in-person care. The remaining studies, which spanned a wide range of care settings, were difficult to interpret as there was no comparison group.[31, 33, 35, 36]

### 5.1.2 PSPs to Reduce or Mitigate Harms Associated With the Use of Telehealth

This rapid review identified no specific interventions that could be characterized as a replicable PSP for addressing potential safety risks in real-time, synchronous video-based telehealth encounters between clinicians and patients. Appendix D details the grey literature reports that communication training, precharting (e.g., comprehensive reviews of patient histories), formalized patient escalation strategies, and education and reporting systems for adverse events have been proposed as PSPs for telemedicine.[37-43] However, this rapid review identified no studies that evaluated the impact of any of the proposed PSPs. Consequently, there is no evidence-base to understand their effectiveness (Question 3), unintended effects (Question 5), or implementation processes (Question 6).

## 5.2 Limitations

As shown in Figure 2, half of the studies identified in this review were from 2021 or later, indicating the science of safety for telehealth is a new and active area of research. The widespread adoption of telehealth during the pandemic may have generated innovations that have not yet made their way into the scientific literature. Telehealth interventions are frequently multicomponent, and coupled with other technology (e.g., mobile health, telephone visits, patient portals, remote monitoring) or care delivery changes (e.g., the adoption of telemedicine as a component of hospital at home care, or as part of a broader redesign of perioperative care). This makes isolating the effects of telehealth difficult.

Rapid reviews use streamlined processes to complete the effort in a narrow timeline. In this review, we limited the studies to published works since 2012, performed within the clinical practices and healthcare systems of the United States, and evaluating video-based telehealth use with real-time encounters between patients and providers. We excluded studies related to asynchronous encounters, audio-only encounters (i.e., telephone visits), encounters using image analysis such as photography, teleconsultation, and remote monitoring of electrical devices. Interactions intended for synchronous video and audio could have reverted to audio only for a variety of reasons (e.g., network bandwidth, patient preference), but this was not systematically evaluated in this review. Additionally, many standard evidence standards and patient care practices were affected by the Coronavirus disease 19 (COVID-19) pandemic and the rapid changes in regulatory standards of care related to telemedicine.

## 5.3 Implications for Clinical Practice and Future Research

The scope of telehealth includes a wide variety of care models including real-time encounters between patients and providers, asynchronous encounters, image-based diagnostics, teleconsultation, and remote telemonitoring. Studies have evaluated the frequency and severity of harms associated with real-time video-based telehealth encounters between clinicians and patients, using a variety of patient safety measures. Studies suggest that telehealth was not inferior to usual care in terms of hospitalizations or ED visits. That is, studies generally reported no statistical differences between telehealth and usual care for patient safety outcomes. No studies have evaluated a specific PSP for reducing potential harms. We cannot make any conclusions about related implementation barriers and facilitators.

This review clearly identifies a gap in the literature and calls for more research to improve understanding of the specific harms associated with real-time use of video-based telehealth and how to prevent or mitigate identified harms. Future research should investigate the existing gaps in evidence, specifically developing and evaluating PSPs for reducing patient safety risks in telehealth. Even though there is no evidence that telehealth poses increased risk compared to usual care, risk remains in care processes and different PSPs may be required in telehealth settings from those used in usual care. This research will need to account for the observed complexity and multicomponent nature of many of the telehealth interventions reported on in this review. Future research should also explore further potential patient safety benefits of telehealth (e.g., if telehealth reduces the no show rate for appointments, does this translate into fewer delays in diagnoses or care?).

Excess utilization and adverse events were impacted by real-time video-based telehealth encounters. We suggest researchers address the evidence gaps by explicitly detailing how proposed telehealth interventions might impact patient safety and including the reporting and frequency of harm to control for confounding variables between intervention and control groups. Patient safety measures and indicators should be explicitly detailed to examine harm and explore how interventions might prevent or mitigate harm. Impactful studies should review barriers and facilitators and provide toolkits to support implementation.

# 6. References


1. What is Telehealth? Health Resources & Services Administration; 2022. https://www.hrsa.gov/rural-health/topics/telehealth/what-is-telehealth. Accessed on February 28, 2022.
2. American Medical Association. American Medical Association; 2023. https://www.ama-assn.org/. Accessed on Frebruary 28, 2023.
3. American Telemedicine Association. Arlington, VA: The American Telemedicine Association; 2023. https://www.americantelemed.org/. Accessed on February 28, 2023.
4. The Office of the National Coordinator for Health Information Technology (ONC). Office of the National Coordinator for Health Information Technology; 2023. https://www.healthit.gov/.
5. Patient Safety Learning hub London, UK: Patient Safety Learning; 2023. https://www.pslhub.org/. Accessed on February 28, 2023.
6. Patient Safety. World Health Organization; 2023. https://www.who.int/teams/integrated-health-services/patient-safety. Accessed on February 28, 2023.
7. Jansson MM, Hyvämäki P, Pikkarainen M. Computer- and Telephone-Delivered Interventions on Patient Outcomes and Resource Utilization in Patients With Orthopaedic Conditions: A Systematic Review and Narrative Synthesis. Orthop Nurs. 2020 Sep/Oct;39(5):340-52. doi: 10.1097/nor.0000000000000699. PMID: 32956277.
8. Kuan PX, Chan WK, Fern Ying DK, et al. Efficacy of telemedicine for the management of cardiovascular disease: a systematic review and meta-analysis. The Lancet Digital Health. 2022;4(9):e676-e91. doi: 10.1016/S2589-7500(22)00124-8.
9. Snoswell CL, Stringer H, Taylor ML, et al. An overview of the effect of telehealth on mortality: A systematic review of meta-analyses. J Telemed Telecare. 2021 Jun 29:1357633x211023700. doi: 10.1177/1357633x211023700. PMID: 34184578.
10. Guise V, Anderson J, Wiig S. Patient safety risks associated with telecare: a systematic review and narrative synthesis of the literature. BMC Health Serv Res. 2014 Nov 25;14:588. doi: 10.1186/s12913-014-0588-z. PMID: 25421823.
11. Bakhit M, Baillie E, Krzyzaniak N, et al. Antibiotic prescribing for acute infections in synchronous telehealth consultations: a systematic review and meta-analysis. BJGP Open. 2021;5(6)doi: 10.3399/bjgpo.2021.0106. PMID: 34497096.
12. Shekelle PG, Pronovost PJ, Wachter RM, et al. Assessing the Evidence for Context-Sensitive Effectiveness and Safety of Patient Safety Practices: Developing Criteria (Prepared under Contract No. HHSA-290-2009-10001C). AHRQ Publication No. 11-0006-EF. Agency for Healthcare Research and Quality. Rockville, MD: 2010.
13. EPC Program Procedures Guide. Rockville, MD: Agency for Healthcare Research and Quality; 2021.
14. Gonzales HM, Fleming JN, Gebregziabher M, et al. Pharmacist-Led Mobile Health Intervention and Transplant Medication Safety: A Randomized Controlled Clinical Trial. Clin J Am Soc Nephrol. 2021 May 8;16(5):776-84. doi: 10.2215/cjn.15911020. PMID: 33931415.
15. Afshari M, Hernandez AV, Nonnekes J, et al. Are Virtual Objective Assessments of Fall-Risk Feasible and Safe for People with Parkinson's Disease? Mov Disord Clin Pract. 2022 Aug;9(6):799-804. doi: 10.1002/mdc3.13494. PMID: 35937474.

16. Blyler CA, Ebinger J, Rashid M, et al. Improving Efficiency of the Barbershop Model of Hypertension Care for Black Men With Virtual Visits. J Am Heart Assoc. 2021 Jul 6;10(13):e020796. doi: 10.1161/jaha.120.020796. PMID: 34155907.

17. Grossman D, Grindlay K. Safety of medication abortion provided through telemedicine: A noninferiority study. Contraception. 2017;95(5):515. doi: 10.1016/j.contraception.2017.02.005.

18. Cooley Hidecker MJ, Landers MR, Piccorelli A, et al. Coordinated speech therapy, physiotherapy, and pharmaceutical care telehealth for people with Parkinson disease in rural communities: an exploratory, 8-week cohort study for feasibility, safety, and signal of efficacy. Rural Remote Health. 2022 Jan;22(1):6679. doi: 10.22605/rrh6679. PMID: 35026120.

19. Jackson JC, Ely EW, Morey MC, et al. Cognitive and physical rehabilitation of intensive care unit survivors: results of the RETURN randomized controlled pilot investigation. Crit Care Med. 2012 Apr;40(4):1088-97. doi: 10.1097/CCM.0b013e3182373115. PMID: 22080631.

20. John BV, Love E, Dahman B, et al. Use of Telehealth Expedites Evaluation and Listing of Patients Referred for Liver Transplantation. Clinical Gastroenterology and Hepatology. 2020;18(8):1822-30.e4. doi: 10.1016/j.cgh.2019.12.021.

21. Keteyian SJ, Grimshaw C, Brawner CA, et al. A Comparison of Exercise Intensity in Hybrid Versus Standard Phase Two Cardiac Rehabilitation. J Cardiopulm Rehabil Prev. 2021 Jan 1;41(1):19-22. doi: 10.1097/hcr.0000000000000569. PMID: 33351540.

22. Levine DM, Paz M, Burke K, et al. Remote vs In-home Physician Visits for Hospital-Level Care at Home: A Randomized Clinical Trial. JAMA Netw Open. 2022 Aug 1;5(8):e2229067. doi: 10.1001/jamanetworkopen.2022.29067. PMID: 36040741.

23. Luxton DD, Pruitt LD, O'Brien K, et al. An Evaluation of the Feasibility and Safety of a Home-Based Telemental Health Treatment for Posttraumatic Stress in the U.S. Military. Telemed J E Health. 2015 Nov;21(11):880-6. doi: 10.1089/tmj.2014.0235. PMID: 26103565.

24. Luxton DD, Pruitt LD, Wagner A, et al. Home-based telebehavioral health for U.S. military personnel and veterans with depression: A randomized controlled trial. Journal of Consulting and Clinical Psychology. 2016;84(11):923-34. doi: 10.1037/ccp0000135.

25. Nikolian VC, Williams AM, Jacobs BN, et al. Pilot study to evaluate the safety, feasibility, and financial implications of a postoperative telemedicine program. Annals of Surgery. 2018;268(4):700-7. doi: 10.1097/SLA.0000000000002931.

26. Olden M, Wyka K, Cukor J, et al. Pilot Study of a Telehealth-Delivered Medication-Augmented Exposure Therapy Protocol for PTSD. Journal of nervous and mental disease. 2017;205(2):154-60. doi: 10.1097/NMD.0000000000000563. PMID: CN-01329291.

27. Tönnies J, Hartmann M, Wensing M, et al. Mental Health Specialist Video Consultations Versus Treatment-as-Usual for Patients With Depression or Anxiety Disorders in Primary Care: Randomized Controlled Feasibility Trial. JMIR Ment Health. 2021 Mar 12;8(3):e22569. doi: 10.2196/22569. PMID: 33709931.

28. Bednarski BK, Nickerson TP, You YN, et al. Randomized clinical trial of accelerated enhanced recovery after minimally invasive colorectal cancer surgery (RecoverMI trial). Br J Surg. 2019 Sep;106(10):1311-8. doi: 10.1002/bjs.11223. PMID: 31216065.

29. Noel K, Messina C, Hou W, et al. Tele-transitions of care (TTOC): a 12-month, randomized controlled trial evaluating the use of Telehealth to achieve triple aim objectives. BMC Fam Pract. 2020 Feb 7;21(1):27. doi: 10.1186/s12875-020-1094-5. PMID: 32033535.

30. Tham E, Nandra K, Whang SE, et al. Postoperative Telehealth Visits Reduce Emergency Department Visits and 30-Day Readmissions in Elective Thoracic Surgery Patients. J Healthc Qual. 2021 Jul-Aug 01;43(4):204-13. doi: 10.1097/jhq.0000000000000299. PMID: 33587528.

31. Shirley L, DiScala S, Brooks A, et al. Pilot of a pharmacist-integrated interprofessional team to optimize prescribing in a telemedicine palliative care clinic. JACCP Journal of the American College of Clinical Pharmacy. 2021;4(9):1093-9. doi: 10.1002/jac5.1478.

32. Harkey K, Kaiser N, Zhao J, et al. Postdischarge Virtual Visits for Low-risk Surgeries: a Randomized Noninferiority Clinical Trial. JAMA surgery. 2021;156(3):221-8. doi: 10.1001/jamasurg.2020.6265. PMID: CN-02231890.

33. Hickey S, Gomez J, Meller B, et al. Interactive home telehealth and burns: A pilot study. Burns. 2017;43(6):1318-21. doi: 10.1016/j.burns.2016.11.013.

34. Delman AM, Turner KM, Jones CR, et al. Keeping the lights on: Telehealth, testing, and 6-month outcomes for orthotopic liver transplantation during the COVID-19 pandemic. Surgery. 2021 Jun;169(6):1519-24. doi: 10.1016/j.surg.2020.12.044. PMID: 33589248.

35. Chu S, Boxer R, Madison P, et al. Veterans Affairs Telemedicine: Bringing Urologic Care to Remote Clinics. Urology. 2015;86(2):255-9. doi: 10.1016/j.urology.2015.04.038.

36. Sherwood BG, Han Y, Nepple KG, et al. Evaluating the Effectiveness, Efficiency and Safety of Telemedicine for Urological Care in the Male Prisoner Population. Urology Practice. 2018;5(1):44-51. doi: 10.1016/j.urpr.2017.01.001.

37. AMA Digital Health Research. American Medical Association 2020. https://www.ama-assn.org/system/files/2020-02/ama-digital-health-study.pdf. Accessed on January 6, 2023.

38. Return on Health: Moving beyond dollars and cents in realizing the value of virtual care American Medical Association 2021. https://www.ama-assn.org/system/files/ama-return-on-health-report.pdf

39. Perry AF, Federico F, Huebner J. Telemedicine: Ensuring Safe, Equitable, Person-Centered Virtual Care. IHI White Paper Institute for Healthcare Improvement. Boston, MA: 2021.

40. Consolidated telemedicine implementation guide World Health Organization. Geneva, Switzerland: 2022. https://www.who.int/publications/i/item/9789240059184

41. O'Malley G, Shaikh U, Marcin J. Telehealth and Patient Safety. Rockville, MD: Agency for Healthcare Research and Quality; 2022. https://psnet.ahrq.gov/primer/telehealth-and-patient-safety. Accessed on February 1, 2023.

42. Agbooola S, Kvedar J. Telemedicine and Patient Safety. Rockville, MD: Agency for Healthcare Research and Quality; 2016. https://psnet.ahrq.gov/perspective/telemedicine-and-patient-safety. Accessed on February 1, 2023.

43. Telehealth and Patient Safety During the COVID-19 Response. Rockville, MD: Agency for Healthcare Research and Quality; 2020. https://psnet.ahrq.gov/perspective/telehealth-and-patient-safety-during-covid-19-response. Accessed on February 1, 2023.

# Authors

Michael Rosen, M.A., Ph.D., C. Matthew Stewart M.D., Ph.D., Hadi Kharrazi, M.H.I., M.D., Ph.D, Ritu Sharma B.Sc., Montrell Vass, B.S., Allen Zhang, B.S., and Eric B. Bass, M.D., M.P.H.

# Peer Reviewers

Prior to publication of the final evidence report, the Evidence Based Practice Center (EPC) sought input from independent Peer Reviewers without financial conflicts of interest. However, the conclusions and synthesis of the scientific literature presented in this report do not necessarily represent the views of individual reviewers. Peer Reviewers must disclose any financial conflicts of interest greater than $5,000 and any other relevant business or professional conflicts of interest. Because of their unique clinical or content expertise, individuals with potential nonfinancial conflicts may be retained. The AHRQ Task Order Officer (TOO) and the EPC work to balance, manage, or mitigate any potential nonfinancial conflicts of interest identified.

The list of Peer Reviewers follows:

Brian William Hasselfeld, M.D.
Senior Medical Director, Digital Health and Innovation
Johns Hopkins Medicine
Baltimore, MD

Bob McNellis, M.P.H., P.A.
Senior Advisor for Disease Prevention
Office of Disease Prevention
National Institutes of Health
Bethesda, MD

# Acknowledgments

The authors gratefully acknowledge the following individuals for their contributions to this project: Susan Henderson, M.D., M.P.H., Medical Officer in the AHRQ Division of Healthcare Associated Infections, who reviewed the report as a subject matter expert, and Ryan Tam and Christin Ko, who helped with screening and abstraction.

# Disclaimers

This report is based on research conducted by the Johns Hopkins University under contract to the Agency for Healthcare Research and Quality (AHRQ), Rockville, MD (Contract No. 75Q80120D00003). The findings and conclusions in this document are those of the authors, who are responsible for its contents; the findings and conclusions do not necessarily represent the views of AHRQ. Therefore, no statement in this report should be construed as an official position of AHRQ or of the U.S. Department of Health and Human Services.

**None of the investigators have any affiliations or financial involvement that conflicts with the material presented in this report.**

The information in this report is intended to help healthcare decision makers—patients and clinicians, health system leaders, and policymakers, among others—make well-informed decisions and thereby improve the quality of healthcare services. This report is not intended to be a substitute for the application of clinical judgment. Anyone who makes decisions concerning the provision of clinical care should consider this report in the same way as any medical reference and in conjunction with all other pertinent information, i.e., in the context of available resources and circumstances presented by individual patients.



A representative from AHRQ served as a Contracting Officer's Representative and reviewed the contract deliverables for adherence to contract requirements and quality. AHRQ did not directly participate in the literature search, determination of study eligibility criteria, data analysis, interpretation of data, or preparation or drafting of this report.

AHRQ appreciates appropriate acknowledgment and citation of its work. Suggested language for acknowledgment: This work was based on an evidence report, Potential Harms Resulting From Patient-Clinician Real-Time Clinical Encounters Using Video-Based Telehealth: A Rapid Evidence Review, by the Evidence-based Practice Center Program at the Agency for Healthcare Research and Quality (AHRQ).

**Suggested citation:** Rosen M, Stewart CM, Kharrazi H, Sharma R, Vass M, Zhang A, Bass EB. Potential Harms Resulting From Patient-Clinician Real-Time Clinical Encounters Using Video-based Telehealth: A Rapid Evidence Review (Prepared by the Johns Hopkins University Evidence-based Practice Center under Contract No. 75Q80120D00003.). AHRQ Publication No. 23-EHC019-2. Rockville, MD: Agency for Healthcare Research and Quality; September 2023. Posted final reports are located on the Effective Health Care Program search page. DOI: https://doi.org/10.23970/AHRQEPC_MHS4TELEHEALTH.

# Afterword

Recognized for excellence in conducting comprehensive systematic reviews, the Agency for Healthcare Research and Quality (AHRQ) Evidence-based Practice Center (EPC) Program is developing a range of rapid evidence products to assist end-users in making specific decisions in a limited timeframe. AHRQ recognizes that people are struggling with urgent questions on how to make healthcare safer. AHRQ is using this rapid format for the fourth edition of its Making Healthcare Safer series of reports, produced by the EPC Program and the General Patient Safety Program. To shorten timelines, reviewers make strategic choices about which processes to abridge. However, the adaptations made for expediency may limit the certainty and generalizability of the findings from the review, particularly in areas with a large literature base. Transparent reporting of the methods used and the resulting limitations of the evidence synthesis are extremely important.

AHRQ expects that these rapid evidence products will be helpful to health plans, providers, purchasers, government programs, and the healthcare system as a whole. Transparency and stakeholder input are essential to AHRQ. If you have comments related to this report, they may be sent by mail to the Task Order Officer named below at: Agency for Healthcare Research and Quality, 5600 Fishers Lane, Rockville, MD 20857, or by email to MHS@ahrq.hhs.gov.


Robert Otto Valdez, Ph.D., M.H.S.A.
Director
Agency for Healthcare Research and Quality

Therese Miller, D.P.H.
Director
Center for Evidence and Practice Improvement
Agency for Healthcare Research and Quality

Craig A. Umscheid, M.D., M.S.
Director
Evidence-based Practice Center Program
Center for Evidence and Practice Improvement
Agency for Healthcare Research and Quality

David W. Niebuhr, M.D., M.P.H., M.Sc.
Evidence-based Practice Center Program Liaison
Center for Evidence and Practice Improvement
Agency for Healthcare Research and Quality

Erin N. Grace, M.H.A.
Acting Director, Healthcare-Associated Infections Division
Deputy Center Director
Center for Quality Improvement and Patient Safety
Agency for Healthcare Research and Quality

Margie Shofer, B.S.N., M.B.A.
Director, General Patient Safety Program
Center for Quality Improvement and Patient Safety
Agency for Healthcare Research and Quality

Jennifer Eskandari
Task Order Officer
Center for Quality Improvement and Patient Safety
Agency for Healthcare Research and Quality

Farzana Samad, PharmD, FISMP, CPPS
Health Scientist Administrator
Center for Quality Improvement and Patient Safety
Agency for Healthcare Research and Quality

# Appendixes

## Appendix A. Methods

## Search Strategies for Published Literature

**Table A-1. PubMed search strategy**

| # | Concept | Search Terms |
|---|---|---|
| 1 | Telehealth | Telemedicine[mh] OR telemedicine[tiab] OR "tele medicine"[tiab] OR telehealth [tiab] OR "tele health"[tiab] OR videoconferencing[mh] OR "video conferencing"[tiab] OR videoconference*[tiab] OR "video conference*"[tiab] OR "video consult*"[tiab] OR "videophone"[tiab] OR "video visit*"[tiab] OR "virtual visit*"[tiab] OR "virtual consult*"[tiab] OR televisit* [tiab] OR "tele visit*"[tiab] OR teleconsult*[tiab] OR "tele consult*"[tiab] |
| 2 | Patient safety/harms | "patient safety"[mh] OR "patient safety" [tiab] OR "Patient Harm"[mh] OR "Patient Harm*"[tiab] OR "patient risk*"[tiab] OR "quality care" [tiab] OR "adverse event*"[tiab] OR "undesired event*"[tiab] OR "medical errors"[mh] OR "medical error*"[tiab] OR "Diagnostic Errors" [mh] OR "diagnostic error*"[tiab] OR "Medical mistake*"[tiab] OR "Diagnostic mistake*"[tiab] OR "Healthcare error*"[tiab] OR "Health care error*"[tiab] OR "erroneous diagnos*"[tiab] OR "failure to diagnose"[tiab] OR "false diagnos*"[tiab] OR "faulty diagnos*"[tiab] OR misdiagnos*[tiab] OR "mistaken diagnos*"[tiab] OR "wrong diagnos*"[tiab] |
| 3. | 1 AND 2 | Telehealth AND Patient safety |
| 4. | Publication limit 2012 - September 2022 | |

**Table A-2. Embase search strategy**

| # | Concept | Search Terms |
|---|---|---|
| 1 | Telehealth | Telemedicine/exp OR telemedicine:ti,ab OR 'tele medicine':ti,ab OR telehealth:ti,ab OR 'tele health':ti,ab OR videoconferencing/exp OR 'video conferencing':ti,ab OR videoconference:ti,ab OR 'video conference':ti,ab OR 'video consult':ti,ab OR 'videophone':ti,ab OR 'video visit':ti,ab OR 'virtual visit':ti,ab OR 'virtual consult':ti,ab OR televisit:ti,ab OR 'tele visit':ti,ab OR teleconsult:ti,ab OR 'tele consult':ti,ab |
| 2 | Patient safety/harms | 'patient safety'/exp OR 'patient safety':ti,ab OR 'Patient Harm'/exp OR 'Patient Harm':ti,ab OR 'patient risk':ti,ab OR 'quality care':ti,ab OR 'adverse event':ti,ab OR 'undesired event':ti,ab OR 'medical errors'/exp OR 'medical error':ti,ab OR 'Diagnostic Errors'/exp OR 'diagnostic error':ti,ab OR 'Medical mistake':ti,ab OR 'Diagnostic mistake':ti,ab OR 'Healthcare error':ti,ab OR 'Health care error':ti,ab OR 'erroneous diagnos':ti,ab OR 'failure to diagnose':ti,ab OR 'false diagnos':ti,ab OR 'faulty diagnos':ti,ab OR misdiagnos:ti,ab OR 'mistaken diagnos':ti,ab OR 'wrong diagnos':ti,ab |
| 3. | 1 AND 2 | Telehealth AND Patient safety |
| 4. | Publication limit 2012 - September 2022 | |

**Table A-3. Cochrane search strategy**

| # | Concept | Search Terms |
|---|---|---|
| 1 | Telehealth | Telemedicine(MESH) OR telemedicine:ti,ab,kw OR 'tele medicine':ti,ab,kw OR telehealth:ti,ab,kw OR 'tele health':ti,ab,kw OR videoconferencing(MESH) OR 'video conferencing':ti,ab,kw OR videoconference:ti,ab,kw OR 'video conference':ti,ab,kw OR 'video consult':ti,ab,kw OR 'videophone':ti,ab,kw OR 'video visit':ti,ab,kw OR 'virtual visit':ti,ab,kw OR 'virtual consult':ti,ab,kw OR televisit:ti,ab,kw OR 'tele visit':ti,ab,kw OR teleconsult:ti,ab,kw OR 'tele consult':ti,ab,kw |
| 2 | Patient safety/harms | 'patient safety'(MESH) OR 'patient safety':ti,ab,kw OR 'Patient Harm'(MESH) OR 'Patient Harm':ti,ab,kw OR 'patient risk':ti,ab,kw OR 'quality care':ti,ab,kw OR 'adverse event':ti,ab,kw OR 'undesired event':ti,ab,kw OR 'medical errors'(MESH) OR 'medical error':ti,ab,kw OR 'Diagnostic Errors'(MESH) OR 'diagnostic error':ti,ab,kw OR 'Medical mistake':ti,ab,kw OR 'Diagnostic mistake':ti,ab,kw OR 'Healthcare error':ti,ab,kw OR 'Health care error':ti,ab,kw OR 'erroneous diagnos':ti,ab,kw OR 'failure to diagnose':ti,ab,kw OR 'false diagnos':ti,ab,kw OR 'faulty diagnos':ti,ab,kw OR misdiagnos:ti,ab,kw OR 'mistaken diagnos':ti,ab,kw OR 'wrong diagnos':ti,ab,kw |
| 3. | 1 AND 2 | Telehealth AND Patient safety |
| 4. | Publication limit 2012 - September 2022 | |

## Appendix B. List of Excluded Studies Upon Full-Text Review

1. Adly AS, Adly AS, Adly MS. Effects of laser acupuncture tele-therapy for rheumatoid arthritis elderly patients. Lasers in Medical Science. 2022;37(1):499-504. doi: 10.1007/s10103-021-03287-0. **- Non-USA based study or does not report data separately for USA**
2. Aiken A, Lohr PA, Lord J, et al. Effectiveness, safety and acceptability of no-test medical abortion (termination of pregnancy) provided via telemedicine: a national cohort study. Bjog. 2021 Aug;128(9):1464-74. doi: 10.1111/1471-0528.16668. PMID: 33605016. **- Non-USA based study or does not report data separately for USA**
3. Aiken ARA, Romanova EP, Morber JR, et al. Safety and effectiveness of self-managed medication abortion provided using online telemedicine in the United States: A population based study. Lancet Reg Health Am. 2022 Jun;10doi: 10.1016/j.lana.2022.100200. PMID: 35755080. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**
4. Anderson T, McClintock AS, McCarrick SS, et al. Working Alliance, Interpersonal Problems, and Depressive Symptoms in Tele-Interpersonal Psychotherapy for HIV-infected Rural Persons: evidence for Indirect Effects. Journal of clinical psychology. 2018;74(3):286-303. doi: 10.1002/jclp.22502. PMID: CN-01794391. **- Audio only visits**
5. Bakas T, Sampsel D, Israel J, et al. Using telehealth to optimize healthy independent living for older adults: A feasibility study. Geriatric nursing. 2018;39(5):566-73. doi: 10.1016/j.gerinurse.2018.04.002. PMID: CN-02416995. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**
6. Banner D, Lear S, Kandola D, et al. The experiences of patients undertaking a 'virtual' cardiac rehabilitation program. Studies in health technology and informatics. 2015;209:9-14. PMID: CN-01215258. **- Non-USA based study or does not report data separately for USA**
7. Batalik L, Konecny V, Dosbaba F, et al. Cardiac Rehabilitation Based on the Walking Test and Telerehabilitation Improved Cardiorespiratory Fitness in People Diagnosed with Coronary Heart Disease during the COVID-19 Pandemic. Int J Environ Res Public Health. 2021 Feb 24;18(5)doi: 10.3390/ijerph18052241. PMID: 33668304. **- Non-USA based study or does not report data separately for USA**
8. Bauer MS, Krawczyk L, Miller CJ, et al. Team-Based Telecare for Bipolar Disorder. Telemed J E Health. 2016 Oct;22(10):855-64. doi: 10.1089/tmj.2015.0255. PMID: 26906927. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

9. Bellsmith KN, Gale MJ, Yang S, et al. Validation of home visual acuity tests for telehealth in the COVID-19 era. Investigative Ophthalmology and Visual Science. 2021;62(8). **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

10. Benvenuti F, Stuart M, Cappena V, et al. Community-based exercise for upper limb paresis: a controlled trial with telerehabilitation. Neurorehabil Neural Repair. 2014 Sep;28(7):611-20. doi: 10.1177/1545968314521003. PMID: 24515928. **- Non-USA based study or does not report data separately for USA**

11. Bera R, Franey E, Martello K, et al. Presence of Caregivers at Telehealth Visits Significantly Improves Virtual Assessment of Drug-Induced Movement Disorders. Movement Disorders Clinical Practice. 2022;9(SUPPL 1):S12-S3. doi: 10.1002/mdc3.13411. **- No original data (opinion, descriptive data, letters, editorial, commentary, protocols)**

12. Bera R, Franey E, Martello K, et al. TeleSCOPE: A Real-World Study of Telehealth for the Detection and Treatment of Drug-Induced Movement Disorders. CNS Spectrums. 2022;27(2):250. doi: 10.1017/S1092852922000621. **- No original data (opinion, descriptive data, letters, editorial, commentary, protocols)**

13. Bernocchi P, Vitacca M, La Rovere MT, et al. Home-based telerehabilitation in older patients with chronic obstructive pulmonary disease and heart failure: a randomised controlled trial. Age and ageing. 2018;47(1):82-8. doi: 10.1093/ageing/afx146. PMID: CN-01425738. **- Non-USA based study or does not report data separately for USA**

14. Bisno DI, Reid MW, Berget C, et al. Group appointments (GA) via home telehealth (HT) for young adults (YA) with type 1 diabetes (T1D) may improve psychosocial functioning. Diabetes. 2019;68doi: 10.2337/db19-801-P. PMID: CN-01995844. **- Conference, meeting, poster abstract only**

15. Bond A, Taylor M, Abraham A, et al. Successful implementation of remote video consultations for patients receiving home parenteral nutrition. Gut. 2018;67:A230-A1. doi: 10.1136/gutjnl-2018-BSGAbstracts.459. **- Conference, meeting, poster abstract only**

16. Bourdon H, Jaillant R, Ballino A, et al. Teleconsultation in primary ophthalmic emergencies during the COVID-19 lockdown in Paris: Experience with 500 patients in March and April 2020. J Fr Ophtalmol. 2020 Sep;43(7):577-85. doi: 10.1016/j.jfo.2020.05.005. PMID: 32564983. **- Non-USA based study or does not report data separately for USA**

17. Bowen DJ, Robbins R, Bush N, et al. Effects of a web-based intervention on women's breast health behaviors. Translational behavioral medicine. 2017;7(2):309-19. doi: 10.1007/s13142-016-0439-z. PMID: CN-01403718. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

18. Bowman A, Denehy L, Benjemaa A, et al. Feasibility and safety of the 30-second sit-to-stand test delivered via telehealth: An observational study. Pm r. 2022 Feb 9doi: 10.1002/pmrj.12783. PMID: 35138036. **- Non-USA based study or does not report data separately for USA**

19. Brahier M, Baker K, Penne M, et al. Patient-Perceived Breakdowns in Telehealth-Diagnosis Early in the COVID-19 Pandemic. An Exploratory Mixed Methods Study. Diagnosis. 2022;9(2):eA76-eA7. doi: 10.1515/dx-2022-0024. **- No original data (opinion, descriptive data, letters, editorial, commentary, protocols)**

20. Brasen CL, Madsen JS, Parkner T, et al. Home Management of Warfarin Treatment Through a Real-Time Supervised Telemedicine Solution: a Randomized Controlled Trial. Telemedicine journal and e-health. 2019;25(2):109-15. doi: 10.1089/tmj.2017.0260. PMID: CN-01793289. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

21. Brocki BC, Andreasen JJ, Aaroe J, et al. Exercise-Based Real-time Telerehabilitation for Older Adult Patients Recently Discharged After Transcatheter Aortic Valve Implantation: Mixed Methods Feasibility Study. JMIR Rehabil Assist Technol. 2022 Apr 26;9(2):e34819. doi: 10.2196/34819. PMID: 35471263. **- Non-USA based study or does not report data separately for USA**

22. Buvanendran A, Burns JW, Moric M, et al. Telemedicine delivered cognitive behavioral therapy (CBT) reduces pain catastrophizing. Regional anesthesia and pain medicine. 2016;41(5) PMID: CN-01333648. **- Conference, meeting, poster abstract only**

23. Buvik A, Bergmo TS, Bugge E, et al. Cost-Effectiveness of Telemedicine in Remote Orthopedic Consultations: randomized Controlled Trial. Journal of medical Internet research. 2019;21(2):e11330. doi: 10.2196/11330. PMID: CN-01791048. **- Non-USA based study or does not report data separately for USA**

24. Caccese M, Imbevaro S, Feltrin A, et al. Cancer Patient-Reported Experience Measures (PREMs) Regarding the Policies Implemented to Contain the Spread of Sars-CoV-2 and Vaccination Campaign at Veneto Institute of Oncology. Patient Prefer Adherence. 2022;16:353-62. doi: 10.2147/ppa.s351771. PMID: 35173420. **- Non-USA based study or does not report data separately for USA**

25. Capin JJ, Jolley SE, Morrow M, et al. Safety, feasibility and initial efficacy of an app-facilitated telerehabilitation (AFTER) program for COVID-19 survivors: a pilot randomised study. BMJ Open. 2022 Jul 26;12(7):e061285. doi: 10.1136/bmjopen-2022-061285. PMID: 35882451. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

26. Casten R, Rovner B, Chang AM, et al. A randomized clinical trial of a collaborative home-based diabetes intervention to reduce emergency department visits and hospitalizations in black individuals with diabetes. Contemporary Clinical Trials. 2020;95doi: 10.1016/j.cct.2020.106069. **- No original data (opinion, descriptive data, letters, editorial, commentary, protocols)**

27. Cerdan de Las Heras J, Balbino F, Catalán-Matamoros D, et al. Effect of a Telerehabilitation program in sarcoidosis. Sarcoidosis Vasc Diffuse Lung Dis. 2022;39(1):e2022003. doi: 10.36141/svdld.v39i1.12526. PMID: 35494172. **- Non-USA based study or does not report data separately for USA**

28. Cha YH, Riley J, Gleghorn D, et al. Remotely Monitored Home-Based Neuromodulation With Transcranial Alternating Current Stimulation (tACS) for Mal de Débarquement Syndrome. Frontiers in Neurology. 2021;12doi: 10.3389/fneur.2021.755645. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

29. Check DK, Winger JG, Jones KA, et al. Predictors of Response to an Evidence-Based Behavioral Cancer Pain Management Intervention: an Exploratory Analysis From a Clinical Trial. Journal of pain and symptom management. 2021;62(2):391-9. doi: 10.1016/j.jpainsymman.2020.12.020. PMID: CN-02251010. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

30. Chen WL, Chiu WT, Wu MS, et al. Translational research of telecare for the treatment of hepatitis C. BioMed Research International. 2014;2014doi: 10.1155/2014/195097. **- Non-USA based study or does not report data separately for USA**

31. Cheville A, Moynihan T, Herrin J, et al. Collaborative Tele-Rehabilitation Among Patients With Advanced Stage Cancers: a Randomized Controlled Trial. Archives of physical medicine and rehabilitation. 2019;100(10):e18-. doi: 10.1016/j.apmr.2019.08.035. PMID: CN-01985203. **- Conference, meeting, poster abstract only**

32. Cheville AL, Moynihan T, Herrin J, et al. Effect of Collaborative Telerehabilitation on Functional Impairment and Pain Among Patients With Advanced-Stage Cancer: a Randomized Clinical Trial. JAMA oncology. 2019;5(5):644-52. doi: 10.1001/jamaoncol.2019.0011. PMID: CN-01937468. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

33. Cho JH, Kim HS, Yoo SH, et al. An Internet-based health gateway device for interactive communication and automatic data uploading: Clinical efficacy for type 2 diabetes in a multi-centre trial. J Telemed Telecare. 2017 Jul;23(6):595-604. doi: 10.1177/1357633x16657500. PMID: 27381040. **- Non-USA based study or does not report data separately for USA**

34. Choi H, Lee SK. Failure mode and effects analysis of telehealth service of minority elderly for sustainable digital transformation. Comput Biol Med. 2022 Sep;148:105950. doi: 10.1016/j.compbiomed.2022.105950. PMID: 35973373. **- Non-USA based study or does not report data separately for USA**

35. Chong E, Shochet T, Raymond E, et al. Expansion of a direct-to-patient telemedicine abortion service in the United States and experience during the COVID-19 pandemic. Contraception. 2021 Jul;104(1):43-8. doi: 10.1016/j.contraception.2021.03.019.

PMID: 33781762. **- Does not report data for adult patients or cannot extract information separately**

36. Choudhary N, Chakravarty K, Kharbanda PS, et al. Satisfaction and effectiveness of tele-medicine in follow-up of people with epilepsy in a resource-poor setting during COVID-19. Epilepsy Behav. 2022 Mar;128:108569. doi: 10.1016/j.yebeh.2022.108569. PMID: 35104733. **- Non-USA based study or does not report data separately for USA**

37. Chowdhury M, Birns J, Rudd A, et al. Telemedicine versus face-to-face evaluation in the delivery of thrombolysis for acute ischaemic stroke: A single centre experience. Postgraduate Medical Journal. 2012;88(1037):134-7. doi: 10.1136/postgradmedj-2011-130060. **- Includes only patients receiving in-patient or emergency department care**

38. Christiansen CL, Miller MJ, Kline PW, et al. Biobehavioral Intervention Targeting Physical Activity Behavior Change for Older Veterans after Nontraumatic Amputation: A Randomized Controlled Trial. Pm r. 2020 Oct;12(10):957-66. doi: 10.1002/pmrj.12374. PMID: 32248638. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

39. Clarke AL, Roscoe J, Appleton R, et al. Promoting integrated care in prostate cancer through online prostate cancer-specific holistic needs assessment: a feasibility study in primary care. Supportive care in cancer. 2020;28(4):1817-27. doi: 10.1007/s00520-019-04967-y. PMID: CN-02124059. **- Non-USA based study or does not report data separately for USA**

40. Comer JS, Furr JM, Kerns CE, et al. Internet-delivered, family-based treatment for early-onset OCD: A pilot randomized trial. J Consult Clin Psychol. 2017 Feb;85(2):178-86. doi: 10.1037/ccp0000155. PMID: 27869451. **- Does not report data for adult patients or cannot extract information separately**

41. Cooper I, Brukner P, Devlin BL, et al. An anti-inflammatory diet intervention for knee osteoarthritis: a feasibility study. BMC Musculoskelet Disord. 2022 Jan 13;23(1):47. doi: 10.1186/s12891-022-05003-7. PMID: 35027029. **- Non-USA based study or does not report data separately for USA**

42. Cordova FC, Ciccolella D, Grabianowski C, et al. A Telemedicine-Based Intervention Reduces the Frequency and Severity of COPD Exacerbation Symptoms: A Randomized, Controlled Trial. Telemed J E Health. 2016 Feb;22(2):114-22. doi: 10.1089/tmj.2015.0035. PMID: 26259074. **- Study of remotely delivered, non-synchronous medical services**

43. Cortes-Penfield NW, LeMaster M, Alexander B. Implementation of a Telehealth-based OPAT Early Post-Discharge Clinic May Reduce Hospital Readmission. Open Forum Infectious Diseases. 2021;8(SUPPL 1):S405. doi: 10.1093/ofid/ofab466.804. **- Conference, meeting, poster abstract only**

44. Cox NS, McDonald CF, Hill CJ, et al. Telerehabilitation for chronic respiratory disease. Cochrane Database of Systematic Reviews. 2018;2018(6)doi: 10.1002/14651858.CD013040. **- No original data (opinion, descriptive data, letters, editorial, commentary, protocols)**

45. Creadore A, Tkachenko E, Li D, et al. 17915 Determining accuracy of teledermatology diagnosis of cellulitis. Journal of the American Academy of Dermatology. 2020;83(6):AB87. doi: 10.1016/j.jaad.2020.06.436. **- Conference, meeting, poster abstract only**

46. Crump CA, Wernz C, Schlachta-Fairchild L, et al. Closing the Digital Health Evidence Gap: Development of a Predictive Score to Maximize Patient Outcomes. Telemed J E Health. 2021 Sep;27(9):1029-38. doi: 10.1089/tmj.2020.0334. PMID: 33170109. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

47. Cuaron JJ, Gillespie EF, Shaverdian N, et al. Safety and Satisfaction of Patients Opting for Fully Remote Consultation and On-Treatment Management Visits During COVID-19. International Journal of Radiation Oncology Biology Physics. 2021;111(3):S111. doi: 10.1016/j.ijrobp.2021.07.256. **- No original data (opinion, descriptive data, letters, editorial, commentary, protocols)**

48. Daly B, Kuperman G, Zervoudakis A, et al. InSight Care Pilot Program: Redefining Seeing a Patient. JCO Oncol Pract. 2020 Oct;16(10):e1050-e9. doi: 10.1200/op.20.00214. PMID: 32468925. **- Study of remotely delivered, non-synchronous medical services**

49. Danila M, Outman R, Rahn E, et al. The activating patients at risk for osteoporosis (apropos) study: a randomized trial within the glow cohort. Journal of bone and mineral research. 2017;31doi: 10.1002/jbmr.3107. PMID: CN-01462255. **- Conference, meeting, poster abstract only**

50. Davis LE, Harnar J, LaChey-Barbee LA, et al. Using Teleneurology to Deliver Chronic Neurologic Care to Rural Veterans: Analysis of the First 1,100 Patient Visits. Telemed J E Health. 2019 Apr;25(4):274-8. doi: 10.1089/tmj.2018.0067. PMID: 30016207. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

51. De Souza MA, Fioretti AC, Vincentin AH, et al. Effectiveness of telemedicine in response to the COVID-19 pandemic. Revista da Associacao Medica Brasileira. 2021;67(10):1427-31. doi: 10.1590/1806-9282.20210611. **- Non-USA based study or does not report data separately for USA**

52. Der-Martirosian C, Griffin AR, Chu K, et al. Telehealth at the US Department of Veterans Affairs after Hurricane Sandy. J Telemed Telecare. 2019 Jun;25(5):310-7. doi: 10.1177/1357633x17751005. PMID: 29384428. **– Does not report on any outcomes, harms, safety measures, or safety indicators**

53. Desai C, Pearce I, Modgil V. Performing sensitive clinical examinations during urological telemedicine visits: How to avoid pitfalls? Research and Reports in Urology.

2021;13:739-44. doi: 10.2147/RRU.S313881. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

54. Dickinson R, Hall S, Sinclair JE, et al. Using technology to deliver cancer follow-up: A systematic review. BMC Cancer. 2014;14(1)doi: 10.1186/1471-2407-14-311. **- Relevant but review (systematic/narrative/scoping)**

55. Dobrzhanskiy O, Kondratskyi Y, Kolesnik A, et al. Role of minimally invasive surgical procedures in treatment of gastric cancer. European journal of surgical oncology. 2019;45(2):e78-. doi: 10.1016/j.ejso.2018.10.282. PMID: CN-01792915. **- No mention of telehealth**

56. Dunkerley S, Thelwall C, Omiawele J, et al. Patient care modifications and hospital regulations during the COVID-19 crisis created inequality and functional hazard for patients with orthopaedic trauma. International Orthopaedics. 2020;44(12):2481-5. doi: 10.1007/s00264-020-04764-x. **- Non-USA based study or does not report data separately for USA**

57. Duru OO, Kemp L, Mirk AK. Telehealth geriatric clinical pharmacy specialist consultation: Integrated management and polypharmacy review of vulnerable elders. Journal of the American Geriatrics Society. 2020;68(SUPPL 1):S278. doi: 10.1111/jgs.16431. **- Conference, meeting, poster abstract only**

58. E WB, Andersson G, Fagelson M, et al. Internet-Based Audiologist-Guided Cognitive Behavioral Therapy for Tinnitus: Randomized Controlled Trial. J Med Internet Res. 2022 Feb 14;24(2):e27584. doi: 10.2196/27584. PMID: 35156936. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

59. Edbrooke L, Khaw P, Freimund A, et al. ENhAncing Lifestyle Behaviors in EndometriaL CancEr (ENABLE): A Pilot Randomized Controlled Trial. Integr Cancer Ther. 2022 Jan-Dec;21:15347354211069885. doi: 10.1177/15347354211069885. PMID: 35045735. **- Non-USA based study or does not report data separately for USA**

60. Egbring M, Far E, Roos M, et al. A Mobile App to Stabilize Daily Functional Activity of Breast Cancer Patients in Collaboration With the Physician: A Randomized Controlled Clinical Trial. J Med Internet Res. 2016 Sep 6;18(9):e238. doi: 10.2196/jmir.6414. PMID: 27601354. **- Non-USA based study or does not report data separately for USA**

61. Egede LE, Acierno R, Knapp RG, et al. Psychotherapy for depression in older veterans via telemedicine: a randomised, open-label, non-inferiority trial. Lancet Psychiatry. 2015 Aug;2(8):693-701. doi: 10.1016/s2215-0366(15)00122-4. PMID: 26249300. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

62. Egede LE, Acierno R, Knapp RG, et al. Psychotherapy for Depression in Older Veterans Via Telemedicine: effect on Quality of Life, Satisfaction, Treatment Credibility, and Service Delivery Perception. Journal of clinical psychiatry. 2016;77(12):1704-11.

doi: 10.4088/JCP.16m10951. PMID: CN-01332957. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

63. Emmett SD, Platt A, Turner EL, et al. Mobile health school screening and telemedicine referral to improve access to specialty care in rural Alaska: a cluster- randomised controlled trial. Lancet Glob Health. 2022 Jul;10(7):e1023-e33. doi: 10.1016/s2214-109x(22)00184-x. PMID: 35714630. **- Does not report data for adult patients or cannot extract information separately**

64. Emonds EE, Pietruszka BL, Hawley CE, et al. There's no place like home-Integrating a pharmacist into the hospital-in-home model. J Am Pharm Assoc (2003). 2021 May-Jun;61(3):e143-e51. doi: 10.1016/j.japh.2021.01.003. PMID: 33551255. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

65. Engel CC, Jaycox LH, Freed MC, et al. Centrally Assisted Collaborative Telecare for Posttraumatic Stress Disorder and Depression Among Military Personnel Attending Primary Care: A Randomized Clinical Trial. JAMA Intern Med. 2016 Jul 1;176(7):948-56. doi: 10.1001/jamainternmed.2016.2402. PMID: 27294447. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

66. Espin A, García-García J, Latorre Erezuma U, et al. Videoconference-Based Physical Performance Tests: Reliability and Feasibility Study. Int J Environ Res Public Health. 2022 Jun 9;19(12)doi: 10.3390/ijerph19127109. PMID: 35742358. **- Non-USA based study or does not report data separately for USA**

67. Fortier CB, Currao A, Kenna A, et al. Online Telehealth Delivery of Group Mental Health Treatment Is Safe, Feasible, and Increases Enrollment and Attendance in Post-9/11 U.S. Veterans. Behavior Therapy. 2022;53(3):469-80. doi: 10.1016/j.beth.2021.11.004. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

68. Fortney JC, Pyne JM, Kimbrell TA, et al. Telemedicine-based collaborative care for posttraumatic stress disorder: a randomized clinical trial. JAMA psychiatry. 2015;72(1):58-67. doi: 10.1001/jamapsychiatry.2014.1575. PMID: CN-01049471. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

69. Frederix I, Hansen D, Coninx K, et al. Effect of comprehensive cardiac telerehabilitation on one-year cardiovascular rehospitalization rate, medical costs and quality of life: a cost-effectiveness analysis. European journal of preventive cardiology. 2016;23(7):674-82. doi: 10.1177/2047487315602257. PMID: CN-01264795. **- Non-USA based study or does not report data separately for USA**

70. Freedman ME, Healy BC, Huffman JC, et al. An At-home Positive Psychology Intervention for Individuals with Multiple Sclerosis: a Phase 1 Randomized Controlled Trial. International journal of MS care. 2021;23(3):128-34. doi: 10.7224/1537-2073.2020-020. PMID: CN-02308978. **- Audio only visits**

71. Frühauf J, Kröck S, Quehenberger F, et al. Mobile teledermatology helping patients control high-need acne: A randomized controlled trial. Journal of the European

Academy of Dermatology and Venereology. 2015;29(5):919-24. doi: 10.1111/jdv.12723. **- Non-USA based study or does not report data separately for USA**

72. Gaetani E, Agostini F, Di Martino L, et al. Beneficial Effects of Remote Medical Care for Patients with Hereditary Hemorrhagic Telangiectasia during the COVID-19 Pandemic. J Clin Med. 2021 May 25;10(11)doi: 10.3390/jcm10112311. PMID: 34070664. **- Non-USA based study or does not report data separately for USA**

73. Galsky MD, Shahin M, Jia R, et al. Telemedicine-Enabled Clinical Trial of Metformin in Patients With Prostate Cancer. JCO Clin Cancer Inform. 2017 Nov;1:1-10. doi: 10.1200/cci.17.00044. PMID: 30657386. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

74. Gao MC, Leung P. Video visits can be both efficient and effective: A systematic review. Journal of General Internal Medicine. 2017;32(2):S378-S9. **- Relevant but review (systematic/narrative/scoping)**

75. Gately ME, Trudeau SA, Moo LR. Feasibility of Telehealth-Delivered Home Safety Evaluations for Caregivers of Clients With Dementia. OTJR (Thorofare N J). 2020 Jan;40(1):42-9. doi: 10.1177/1539449219859935. PMID: 31319745. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

76. Giel KE, Leehr EJ, Becker S, et al. Relapse Prevention via Videoconference for Anorexia Nervosa-Findings from the RESTART Pilot Study. Psychotherapy and Psychosomatics. 2015;84(6):381-3. doi: 10.1159/000431044. **- Non-USA based study or does not report data separately for USA**

77. Gilmore AK, Davis MT, Grubaugh A, et al. "Do you expect me to receive PTSD care in a setting where most of the other patients remind me of the perpetrator?": home-based telemedicine to address barriers to care unique to military sexual trauma and veterans affairs hospitals. Contemporary clinical trials. 2016;48:59-64. doi: 10.1016/j.cct.2016.03.004. PMID: CN-01265211. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

78. Gomaa S, West C, Lopez AM, et al. A Telehealth-Delivered Tai Chi Intervention (TaiChi4Joint) for Managing Aromatase Inhibitor-Induced Arthralgia in Patients With Breast Cancer During COVID-19: Longitudinal Pilot Study. JMIR Form Res. 2022 Jun 21;6(6):e34995. doi: 10.2196/34995. PMID: 35727609. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

79. Goudman L, De Smedt A, Huygens R, et al. Hospital at home for intrathecal pump refills: A prospective effectiveness, safety and feasibility study. Journal of Clinical Medicine. 2021;10(22)doi: 10.3390/jcm10225353. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

80. Grant LA, Rockwood T, Stennes L. Client satisfaction with telehealth services in home health care agencies. J Telemed Telecare. 2015 Mar;21(2):88-92. doi: 10.1177/1357633x14566589. PMID: 25586811. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

81. Grubbs KM, Fortney JC, Pyne J, et al. A Comparison of Collaborative Care Outcomes in Two Health Care Systems: VA Clinics and Federally Qualified Health Centers. Psychiatric services (Washington, D.C.). 2018;69(4):431-7. doi: 10.1176/appi.ps.201700067. PMID: CN-01952247. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

82. Guarnieri G, Caminati M, Achille A, et al. Severe Asthma, Telemedicine, and Self-Administered Therapy: Listening First to the Patient. J Clin Med. 2022 Feb 12;11(4)doi: 10.3390/jcm11040960. PMID: 35207233. **- Non-USA based study or does not report data separately for USA**

83. Gunasekeran DV, Liu Z, Tan WJ, et al. Evaluating safety and efficacy of follow-up for patients with abdominal pain using video consultation (SAVED Study): Randomized controlled trial. Journal of Medical Internet Research. 2020;22(6)doi: 10.2196/17417. **- Non-USA based study or does not report data separately for USA**

84. Haddad PA, Hammoud D, Phelan M, et al. Barriers to Virtual Video Connect (VVC)cancer care among southern rural veterans during theCOVID19 pandemic. Clinical Cancer Research. 2020;26(18 SUPPL)doi: 10.1158/1557-3265.COVID-19-PO-006. **- Conference, meeting, poster abstract only**

85. Hahnel FS, Topfer NF, Wilz G. Effects of nursing home placement on the mental health trajectories of family caregivers of people with dementia: findings from the Tele.TAnDem intervention study. Aging & mental health. 2022:1-9. doi: 10.1080/13607863.2021.2022598. PMID: CN-02362319. **- Non-USA based study or does not report data separately for USA**

86. Hamatani S, Matsumoto K, Takahashi J, et al. Feasibility of guided internet-based cognitive behavioral therapy for patients with anorexia nervosa. Internet Interv. 2022 Mar;27:100504. doi: 10.1016/j.invent.2022.100504. PMID: 35257002. **- Non-USA based study or does not report data separately for USA**

87. Harrell KM, Wilkins SS, Connor MK, et al. Telemedicine and the evaluation of cognitive impairment: The additive value of neuropsychological assessment. Journal of the American Medical Directors Association. 2014;15(8):600-6. doi: 10.1016/j.jamda.2014.04.015. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

88. Hasani F, Haines T, Munteanu SE, et al. LOAD-intensity and time-under-tension of exercises for men who have Achilles tendinopathy (the LOADIT trial): a randomised feasibility trial. BMC Sports Sci Med Rehabil. 2021 May 25;13(1):57. doi: 10.1186/s13102-021-00279-z. PMID: 34034816. **- Non-USA based study or does not report data separately for USA**

89. Healy P, McCrone L, Tully R, et al. Virtual outpatient clinic as an alternative to an actual clinic visit after surgical discharge: a randomised controlled trial. BMJ quality & safety. 2019;28(1):24-31. doi: 10.1136/bmjqs-2018-008171. PMID: CN-02078646. **- Non-USA based study or does not report data separately for USA**

90. Hekman D, Maldonado SM, Wolverton J, et al. Video visits for isotretinoin patients are perceived as safe, effective, and convenient. Dermatology Online Journal. 2021;27(4)doi: 10.5070/D3274053167. **- Does not report data for adult patients or cannot extract information separately**

91. Held P, Kovacevic M, Petrey K, et al. Treating posttraumatic stress disorder at home in a single week using 1-week virtual massed cognitive processing therapy. J Trauma Stress. 2022 Aug;35(4):1215-25. doi: 10.1002/jts.22831. PMID: 35338534. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

92. Hernandez A, Afshari M, Nonnekes J, et al. Feasibility of Objectively Assessing Fall Risk Over Telemedicine in Parkinson's Disease Patients. Movement Disorders Clinical Practice. 2022;9(SUPPL 1):S43. doi: 10.1002/mdc3.13411. **- No original data (opinion, descriptive data, letters, editorial, commentary, protocols)**

93. Hradská K, Popková T, Skořupová M, et al. Management of Treatment-Related Infectious Complications in High-Risk Hemato-Oncological Patients via Telemedicine. Cancer Manag Res. 2022;14:1655-61. doi: 10.2147/cmar.s348923. PMID: 35547597. **- Non-USA based study or does not report data separately for USA**

94. Hull TD, Malgaroli M, Gazzaley A, et al. At-home, sublingual ketamine telehealth is a safe and effective treatment for moderate to severe anxiety and depression: Findings from a large, prospective, open-label effectiveness trial. J Affect Disord. 2022 Oct 1;314:59-67. doi: 10.1016/j.jad.2022.07.004. PMID: 35809678. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

95. Hungerbuehler I, Valiengo L, Loch AA, et al. Home-Based Psychiatric Outpatient Care Through Videoconferencing for Depression: A Randomized Controlled Follow-Up Trial. JMIR Ment Health. 2016 Aug 3;3(3):e36. doi: 10.2196/mental.5675. PMID: 27489204. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

96. Hwang R, Bruning J, Morris NR, et al. Home-based telerehabilitation is not inferior to a centre-based program in patients with chronic heart failure: a randomised trial. J Physiother. 2017 Apr;63(2):101-7. doi: 10.1016/j.jphys.2017.02.017. PMID: 28336297. **- Non-USA based study or does not report data separately for USA**

97. Hwang R, Mandrusiak A, Morris NR, et al. Assessing functional exercise capacity using telehealth: Is it valid and reliable in patients with chronic heart failure? J Telemed Telecare. 2017 Feb;23(2):225-32. doi: 10.1177/1357633x16634258. PMID: 26915366. **- Non-USA based study or does not report data separately for USA**

98. Iturri JBG, Gomez A, Guell R, et al. A respiratory telerehabilitation program as maintenance in patients with chronic obstructive pulmonary disease. European respiratory journal. 2018;52doi: 10.1183/13993003.congress-2018.PA2049. PMID: CN-01914929. **- Non-USA based study or does not report data separately for USA**

99. Jacobs JM, Post K, Massad K, et al. A telehealth intervention for symptom management, distress, and adherence to adjuvant endocrine therapy: a randomized controlled trial. Cancer. 2022doi: 10.1002/cncr.34409. PMID: CN-02428738. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

100. Jakobsen AS, Laursen LC, Rydahl-Hansen S, et al. Home-based telehealth hospitalization for exacerbation of chronic obstructive pulmonary disease: findings from "the virtual hospital" trial. Telemed J E Health. 2015 May;21(5):364-73. doi: 10.1089/tmj.2014.0098. PMID: 25654366. **- Non-USA based study or does not report data separately for USA**

101. Jarbandhan A, Toelsie J, Veeger D, et al. Feasibility of a home-based physiotherapy intervention to promote post-stroke mobility: A randomized controlled pilot study. PLoS ONE. 2022;17(3 March 2022)doi: 10.1371/journal.pone.0256455. **- Non-USA based study or does not report data separately for USA**

102. Jazieh AR, Akbulut H, Curigliano G, et al. The impact of COVID-19 pandemic on cancer care: A global collaborative study. Annals of Oncology. 2020;31:S1209-S10. doi: 10.1016/j.annonc.2020.08.2325. **- Non-USA based study or does not report data separately for USA**

103. Jimenez S, Enjuanes C, Verdu-Rotellar JM, et al. Impact on clinical events and healthcare costs of adding telemedicine to multidisciplinary care of patients with heart failure and mid-range or preserved LVEF: a randomised controlled trial. European heart journal. 2017;38:509-. doi: 10.1093/eurheartj/ehx502.P2466. PMID: CN-01468853. **- Non-USA based study or does not report data separately for USA**

104. Jue JS, Spector SA, Spector SA. Telemedicine broadening access to care for complex cases. J Surg Res. 2017 Dec;220:164-70. doi: 10.1016/j.jss.2017.06.085. PMID: 29180178. **- Other: Telehealth conducted in clinical setting only**

105. Kane-Gill SL, Wong A, Culley CM, et al. Transforming the Medication Regimen Review Process Using Telemedicine to Prevent Adverse Events. J Am Geriatr Soc. 2021 Feb;69(2):530-8. doi: 10.1111/jgs.16946. PMID: 33233016. **- Study of remotely delivered, non-synchronous medical services**

106. Kapp N, Andersen K, Griffin R, et al. Medical abortion at 13 or more weeks gestation provided through telemedicine: A retrospective review of services. Contracept X. 2021;3:100057. doi: 10.1016/j.conx.2021.100057. PMID: 33615210. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

107. Kasschau M, Reisner J, Sherman K, et al. Transcranial Direct Current Stimulation Is Feasible for Remotely Supervised Home Delivery in Multiple Sclerosis.

Neuromodulation. 2016 Dec;19(8):824-31. doi: 10.1111/ner.12430. PMID: 27089545. **- Audio only visits**

108. Katz IJ, Pirabhahar S, Williamson P, et al. iConnect CKD - virtual medical consulting: a web-based chronic kidney disease, hypertension and diabetes integrated care program. Nephrology (Carlton, Vic.). 2018;23(7):646-52. doi: 10.1111/nep.13070. PMID: CN-01617741. **- Non-USA based study or does not report data separately for USA**

109. Katz MH, Slack R, Bruno M, et al. Outpatient virtual clinical encounters after complex surgery for cancer: a prospective pilot study of "TeleDischarge". J Surg Res. 2016 May 1;202(1):196-203. doi: 10.1016/j.jss.2015.12.054. PMID: 27083967. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

110. Kavousi Y, Al-Adas Z, Crutchfield JM, et al. Early clinical experience using telemedicine for the management of patients with varicose vein disease. J Telemed Telecare. 2019 Jan;25(1):54-8. doi: 10.1177/1357633x17734580. PMID: 28969485. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

111. Keller K, Göbel S, Ten Cate V, et al. Telemedicine-Based Specialized Care Improves the Outcome of Anticoagulated Individuals with Venous Thromboembolism-Results from the thrombEVAL Study. J Clin Med. 2020 Oct 13;9(10)doi: 10.3390/jcm9103281. PMID: 33066188. **- Non-USA based study or does not report data separately for USA**

112. Kennelty KA, Coffey CS, Ardery G, et al. A cluster randomized trial to evaluate a centralized remote clinical pharmacy service in large, health system primary care clinics. JACCP Journal of the American College of Clinical Pharmacy. 2021;4(10):1287-99. doi: 10.1002/jac5.1497. PMID: CN-02304223. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

113. Kent A, Kim H, Bhargava V, et al. Patient-Specific Outcomes of Transcutaneous Afferent Patterned Stimulation with Varying Frequencies for Essential Tremor. Movement Disorders Clinical Practice. 2022;9(SUPPL 1):S68-S9. doi: 10.1002/mdc3.13411. **- No original data (opinion, descriptive data, letters, editorial, commentary, protocols)**

114. Khrlobyan M, Burchette R, Modjtahedi B, et al. Alteplase within 4.5 hours via telemedicine and in-person for central or branch retinal artery occlusion vs medical management. Stroke. 2021;52(SUPPL 1)doi: 10.1161/str.52.suppl-1.P16. **- Includes only patients receiving in-patient or emergency department care**

115. Kikuchi A, Taniguchi T, Nakamoto K, et al. Feasibility of home-based cardiac rehabilitation using an integrated telerehabilitation platform in elderly patients with heart failure: A pilot study. J Cardiol. 2021 Jul;78(1):66-71. doi: 10.1016/j.jjcc.2021.01.010. PMID: 33579602. **- Non-USA based study or does not report data separately for USA**

116. Kloek CJJ, Bossen D, Spreeuwenberg PM, et al. Effectiveness of a Blended Physical Therapist Intervention in People With Hip Osteoarthritis, Knee Osteoarthritis, or Both: a Cluster-Randomized Controlled Trial. Physical therapy. 2018;98(7):560-70. doi: 10.1093/ptj/pzy045. PMID: CN-01944256. **- Non-USA based study or does not report data separately for USA**

117. Knox L, Dunning M, Davies CA, et al. Safety, feasibility, and effectiveness of virtual pulmonary rehabilitation in the real world. Int J Chron Obstruct Pulmon Dis. 2019;14:775-80. doi: 10.2147/copd.s193827. PMID: 31040656. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

118. Kohn JE, Snow JL, Simons HR, et al. Medication Abortion Provided Through Telemedicine in Four U.S. States. Obstet Gynecol. 2019 Aug;134(2):343-50. doi: 10.1097/aog.0000000000003357. PMID: 31306317. **- Other: Non-home setting**

119. Kohn JE, Snow JL, Simons HR, et al. Safety and effectiveness of medication abortion provided via telemedicine at Planned Parenthood in four U.S. states. Contraception. 2019;99(5):317. doi: 10.1016/j.contraception.2019.03.008. **- Conference, meeting, poster abstract only**

120. Koppenaal T, Pisters MF, Kloek CJ, et al. The 3-Month Effectiveness of a Stratified Blended Physiotherapy Intervention in Patients With Nonspecific Low Back Pain: cluster Randomized Controlled Trial. Journal of medical Internet research. 2022;24(2):e31675. doi: 10.2196/31675. PMID: CN-02375655. **- Non-USA based study or does not report data separately for USA**

121. Koysombat K, Plonczak AM, West CA. The role of teleconsultation in the management of suspected skin malignancy in plastic surgery during COVID-19 outbreak: A single centre experience. Journal of Plastic, Reconstructive and Aesthetic Surgery. 2021;74(8):1931-71. doi: 10.1016/j.bjps.2021.03.003. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

122. Kubes JN, Graetz I, Wiley Z, et al. Associations of telemedicine vs. in-person ambulatory visits and cancellation rates and 30-day follow-up hospitalizations and emergency department visits. Prev Med Rep. 2021 Dec;24:101629. doi: 10.1016/j.pmedr.2021.101629. PMID: 34976682. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

123. Kurth AE, Spielberg F, Cleland CM, et al. Computerized counseling reduces HIV-1 viral load and sexual transmission risk: findings from a randomized controlled trial. Journal of acquired immune deficiency syndromes (1999). 2014;65(5):611-20. doi: 10.1097/QAI.0000000000000100. PMID: CN-00984257. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

124. Ladin K, Porteny T, Perugini JM, et al. Perceptions of Telehealth vs In-Person Visits Among Older Adults With Advanced Kidney Disease, Care Partners, and Clinicians. JAMA Netw Open. 2021 Dec 1;4(12):e2137193.

doi: 10.1001/jamanetworkopen.2021.37193. PMID: 34870680. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

125. Lai B, Rimmer J, Barstow B, et al. Teleexercise for Persons With Spinal Cord Injury: A Mixed-Methods Feasibility Case Series. JMIR Rehabil Assist Technol. 2016 Jul 14;3(2):e8. doi: 10.2196/rehab.5524. PMID: 28582252. **- Does not report on any outcomes, harms, safety measures, or safety indicators**
126. Landtblom AM, Guala D, Hau S, et al. RebiQoL: a telemedicine patient support program on health related quality of life and adherence in MS patients treated with Rebif. Multiple sclerosis journal. 2017;23(3):425-. doi: 10.1177/1352458517731404. PMID: CN-01427977. **- Non-USA based study or does not report data separately for USA**
127. Landtblom AM, Guala D, Martin C, et al. RebiQoL: A randomized trial of telemedicine patient support program for health-related quality of life and adherence in people with MS treated with Rebif. PLoS One. 2019;14(7):e0218453. doi: 10.1371/journal.pone.0218453. PMID: 31276502. **- Non-USA based study or does not report data separately for USA**
128. Laub N, Agarwal AK, Shi C, et al. Delivering Urgent Care Using Telemedicine: Insights from Experienced Clinicians at Academic Medical Centers. J Gen Intern Med. 2022 Mar;37(4):707-13. doi: 10.1007/s11606-020-06395-9. PMID: 34919208. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**
129. Lavu H, McCall NS, Winter JM, et al. Enhancing Patient Outcomes while Containing Costs after Complex Abdominal Operation: a Randomized Controlled Trial of the Whipple Accelerated Recovery Pathway. Journal of the American College of Surgeons. 2019;228(4):415-24. doi: 10.1016/j.jamcollsurg.2018.12.032. PMID: CN-02084093. **- Does not report on any outcomes, harms, safety measures, or safety indicators**
130. Lawrenz JM, Krout JC, Moran CP, et al. Telemedicine in Orthopedic Oncology During COVID-19: Patient Satisfaction, Reimbursement, and Physical Examination Competency. Orthopedics. 2021 Sep-Oct;44(5):274-9. doi: 10.3928/01477447-20210819-09. PMID: 34590949. **- Does not report data for adult patients or cannot extract information separately**
131. Layman SN, Elliott WV, Regen SM, et al. Implementation of a pharmacist-led transitional care clinic. Am J Health Syst Pharm. 2020 Jun 4;77(12):966-71. doi: 10.1093/ajhp/zxaa080. PMID: 32374382. **- Audio only visits**
132. Lees C, Campbell J, Cheng K, et al. Outcomes of Converting a Rapid Access Chest Pain Clinic to Telehealth Care During the COVID-19 pandemic. Heart Lung and Circulation. 2021;30:S235. doi: 10.1016/j.hlc.2021.06.311. **- Non-USA based study or does not report data separately for USA**
133. Leighton C, Conroy M, Bilderback A, et al. Implementation and Impact of a Maternal-Fetal Medicine Telemedicine Program. Am J Perinatol. 2019 Jun;36(7):751-8.

doi: 10.1055/s-0038-1675158. PMID: 30380582. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

134. Levine DM, Ouchi K, Blanchfield BB, et al. Hospital-level care at home for acutely ill adults: a randomized controlled trial. Journal of general internal medicine. 2018;33(2):221-2. PMID: CN-01606202. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**
135. Levine DM, Schnipper JL. Remote physician care for home hospital patients: A randomized controlled noninferiority trial. Journal of General Internal Medicine. 2021;36(SUPPL 1):S48. doi: 10.1007/s11606-021-06830-5. **- Conference, meeting, poster abstract only**
136. Li JO, Thomas AAP, Kilduff CLS, et al. Safety of video-based telemedicine compared to in-person triage in emergency ophthalmology during COVID-19. EClinicalMedicine. 2021 Apr;34:100818. doi: 10.1016/j.eclinm.2021.100818. PMID: 33842860. **- Non-USA based study or does not report data separately for USA**
137. Li QP, Li J, Pan HY. Effects of online home nursing care model application on patients with traumatic spinal cord injury. Risk management and healthcare policy. 2021;14:1703-9. doi: 10.2147/RMHP.S301874. PMID: CN-02309424. **- Non-USA based study or does not report data separately for USA**
138. List R, Compton MH, Soper M, et al. Preserving multidisciplinary care model and patient safety during re-opening of ambulatory CF clinic for non-urgent care-a hybrid telehealth model. Pediatric Pulmonology. 2020;55(SUPPL 2):307-8. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**
139. Liu SX, Xiang R, Lagor C, et al. Economic Modeling of Heart Failure Telehealth Programs: When Do They Become Cost Saving? Int J Telemed Appl. 2016;2016:3289628. doi: 10.1155/2016/3289628. PMID: 27528868. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**
140. Livori AC, Bishop JL, Ping SE, et al. Towards OPtimising Care of Regionally-Based Cardiac Patients With a Telehealth Cardiology Pharmacist Clinic (TOPCare Cardiology). Heart Lung Circ. 2021 Jul;30(7):1023-30. doi: 10.1016/j.hlc.2020.12.015. PMID: 33622616. **- Non-USA based study or does not report data separately for USA**
141. Locke DEC, Khayoun R, Shandera-Ochsner AL, et al. Innovation Inspired by COVID: A Virtual Treatment Program for Patients With Mild Cognitive Impairment at Mayo Clinic. Mayo Clin Proc Innov Qual Outcomes. 2021 Oct;5(5):820-6. doi: 10.1016/j.mayocpiqo.2021.06.004. PMID: 34423257. **- Does not report on any outcomes, harms, safety measures, or safety indicators**
142. Ma DDF, Fennessy K, Kliman D. Potential benefits of a virtual, home-based combined exercise and mindfulness training program for HSC transplant survivors: a single-arm pilot study. BMC Sports Sci Med Rehabil. 2022 Sep 5;14(1):167.

doi: 10.1186/s13102-022-00554-7. PMID: 36064618. **- Non-USA based study or does not report data separately for USA**

143. Madden N, Emeruwa UN, Friedman AM, et al. Telehealth Uptake into Prenatal Care and Provider Attitudes during the COVID-19 Pandemic in New York City: A Quantitative and Qualitative Analysis. Am J Perinatol. 2020 Aug;37(10):1005-14. doi: 10.1055/s-0040-1712939. PMID: 32516816. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

144. Malliaras P, Cridland K, Hopmans R, et al. Internet and Telerehabilitation-Delivered Management of Rotator Cuff-Related Shoulder Pain (INTEL Trial): Randomized Controlled Pilot and Feasibility Trial. JMIR Mhealth Uhealth. 2020 Nov 18;8(11):e24311. doi: 10.2196/24311. PMID: 33206059. **- Non-USA based study or does not report data separately for USA**

145. Martin I, Braem F, Baudet L, et al. Follow-up of functional exercise capacity in patients with COVID-19: It is improved by telerehabilitation. Respir Med. 2021 Jul;183:106438. doi: 10.1016/j.rmed.2021.106438. PMID: 33964817. **- Non-USA based study or does not report data separately for USA**

146. Matsumoto K, Sutoh C, Asano K, et al. Internet-Based Cognitive Behavioral Therapy With Real-Time Therapist Support via Videoconference for Patients With Obsessive-Compulsive Disorder, Panic Disorder, and Social Anxiety Disorder: Pilot Single-Arm Trial. J Med Internet Res. 2018 Dec 17;20(12):e12091. doi: 10.2196/12091. PMID: 30559094. **- Non-USA based study or does not report data separately for USA**

147. Mayer KP, Parry SM, Kalema AG, et al. Safety and Feasibility of an Interdisciplinary Treatment Approach to Optimize Recovery From Critical Coronavirus Disease 2019. Crit Care Explor. 2021 Aug;3(8):e0516. doi: 10.1097/cce.0000000000000516. PMID: 34476403. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

148. Mínguez P, Cadavid B, Mata C, et al. Early assisted discharge with generic telemedicine for chronic obstructive pulmonary disease exacerbations: results of a randomized controlled trial. Chest. 2014;145(3)doi: 10.1378/chest.1793561. PMID: CN-00991355. **- Conference, meeting, poster abstract only**

149. Monte Soldado A, López-Masrramon B, Aguilera-Sáez J, et al. Implementation and evaluation of telemedicine in burn care: Study of clinical safety and technical feasibility in a single burn center. Burns. 2020;46(7):1668-73. doi: 10.1016/j.burns.2020.04.027. **- Non-USA based study or does not report data separately for USA**

150. Morris ME, Slade SC, Wittwer JE, et al. Online Dance Therapy for People With Parkinson's Disease: Feasibility and Impact on Consumer Engagement. Neurorehabil Neural Repair. 2021 Dec;35(12):1076-87. doi: 10.1177/15459683211046254. PMID: 34587834. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

151. Motz V, Faust A, Dahmus J, et al. Utilization of a Directly Supervised Telehealth-Based Exercise Training Program in Patients With Nonalcoholic Steatohepatitis: Feasibility Study. JMIR Form Res. 2021 Aug 17;5(8):e30239. doi: 10.2196/30239. PMID: 34402795. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

152. Müller KI, Alstadhaug KB, Bekkelund SI. A randomized trial of telemedicine efficacy and safety for nonacute headaches. Neurology. 2017;89(2):153-62. doi: 10.1212/WNL.0000000000004085. PMID: CN-01381450. **- Non-USA based study or does not report data separately for USA**

153. Mullur J, Chen YC, Wickner P, et al. Ambulatory Virtual Care During a Pandemic: Patient Safety Considerations. J Patient Saf. 2022 Mar 1;18(2):e431-e8. doi: 10.1097/pts.0000000000000832. PMID: 35188931. **- Audio only visits**

154. Nakagawa K, Umazume T, Mayama M, et al. Feasibility and safety of urgently initiated maternal telemedicine in response to the spread of COVID-19: A 1-month report. Journal of Obstetrics and Gynaecology Research. 2020;46(10):1967-71. doi: 10.1111/jog.14378. **- Non-USA based study or does not report data separately for USA**

155. Newman-Casey PA, De Lott L, Cho J, et al. Telehealth-based Eye Care During the COVID-19 Pandemic: Utilization, Safety, and the Patient Experience. Am J Ophthalmol. 2021 Oct;230:234-42. doi: 10.1016/j.ajo.2021.04.014. PMID: 33940006. **- Interventions focusing exclusively on providing access to telehealth**

156. Ngu S, Wei N, Li J, et al. Nurse-led follow-up in survivorship care of gynaecological malignancies—A randomised controlled trial. European journal of cancer care. 2020;29(6):1-8. doi: 10.1111/ecc.13325. PMID: CN-02418467. **- Non-USA based study or does not report data separately for USA**

157. Nguyen MT, Garcia F, Juarez J, et al. Satisfaction can co-exist with hesitation: qualitative analysis of acceptability of telemedicine among multi-lingual patients in a safety-net healthcare system during the COVID-19 pandemic. BMC Health Serv Res. 2022 Feb 14;22(1):195. doi: 10.1186/s12913-022-07547-9. PMID: 35164746. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

158. Nie P, Zhang J, Yang X, et al. Remote Programming in Patients With Parkinson's Disease After Deep Brain Stimulation: Safe, Effective, and Economical. Front Neurol. 2022;13:879250. doi: 10.3389/fneur.2022.879250. PMID: 35592473. **- Non-USA based study or does not report data separately for USA**

159. Nielssen O, Dear BF, Staples LG, et al. Procedures for risk management and a review of crisis referrals from the MindSpot Clinic, a national service for the remote assessment and treatment of anxiety and depression. BMC Psychiatry. 2015;15(1)doi: 10.1186/s12888-015-0676-6. **- Non-USA based study or does not report data separately for USA**

160. Nolan RP, Feldman R, Dawes M, et al. Randomized Controlled Trial of E-Counseling for Hypertension: REACH. Circulation. Cardiovascular quality and outcomes. 2018;11(7):e004420. doi: 10.1161/CIRCOUTCOMES.117.004420. PMID: CN-01614418. **- Non-USA based study or does not report data separately for USA**

161. Odnoletkova I, Goderis G, Nobels F, et al. Optimizing diabetes control in people with Type 2 diabetes through nurse-led telecoaching. Diabetic medicine. 2016;33(6):777-85. doi: 10.1111/dme.13092. PMID: CN-01159109. **- Non-USA based study or does not report data separately for USA**

162. Olayiwola JN, Anderson D, Jepeal N, et al. Electronic Consultations to Improve the Primary Care-Specialty Care Interface for Cardiology in the Medically Underserved: a Cluster-Randomized Controlled Trial. Annals of family medicine. 2016;14(2):133-40. doi: 10.1370/afm.1869. PMID: CN-01307567. **- No mention of telehealth**

163. Olivieri J, Perna GP, Bocci C, et al. Modern Management of Anthracycline-Induced Cardiotoxicity in Lymphoma Patients: Low Occurrence of Cardiotoxicity with Comprehensive Assessment and Tailored Substitution by Nonpegylated Liposomal Doxorubicin. Oncologist. 2017 Apr;22(4):422-31. doi: 10.1634/theoncologist.2016-0289. PMID: 28275118. **- Non-USA based study or does not report data separately for USA**

164. Ong CSH, Lu J, Tan YQ, et al. Implementation of a Ureteric Colic Telemedicine Service: A Mixed Methods Quality Improvement Study. Urology. 2021 Jan;147:14-20. doi: 10.1016/j.urology.2020.10.010. PMID: 33091386. **- Non-USA based study or does not report data separately for USA**

165. Øra HP, Kirmess M, Brady MC, et al. Technical Features, Feasibility, and Acceptability of Augmented Telerehabilitation in Post-stroke Aphasia—Experiences From a Randomized Controlled Trial. Frontiers in Neurology. 2020;11doi: 10.3389/fneur.2020.00671. **- Non-USA based study or does not report data separately for USA**

166. Palacín-Marín F, Esteban-Moreno B, Olea N, et al. Agreement between telerehabilitation and face-to-face clinical outcome assessments for low back pain in primary care. Spine. 2013;38(11):947-52. doi: 10.1097/BRS.0b013e318281a36c. PMID: CN-00966410. **- Non-USA based study or does not report data separately for USA**

167. Parnell K, Kuhlenschmidt K, Madni D, et al. Using telemedicine on an acute care surgery service: improving clinic efficiency and access to care. Surg Endosc. 2021 Oct;35(10):5760-5. doi: 10.1007/s00464-020-08055-9. PMID: 33048233. **- Audio only visits**

168. Pastora-Bernal JM, Martín-Valero R, Barón-López FJ, et al. Telerehabilitation after arthroscopic subacromial decompression is effective and not inferior to standard practice: preliminary results. Journal of telemedicine and telecare. 2018;24(6):428-33.

doi: 10.1177/1357633X17706583. PMID: CN-01643537. **- Non-USA based study or does not report data separately for USA**

169. Patel H, Wahlstrom SK, DerSarkissian M, et al. Time and Personnel Costs Associated with Adverse Event (AE) Management Among Patients with Chronic Lymphocytic Leukemia (CLL) Treated with Acalabrutinib, Ibrutinib, or Venetoclax. Blood. 2021;138:2999. doi: 10.1182/blood-2021-147449. **- Conference, meeting, poster abstract only**
170. Pathak S, Haynes M, Qato DM, et al. Telepharmacy and Quality of Medication Use in Rural Areas, 2013-2019. Prev Chronic Dis. 2020 Sep 3;17:E101. doi: 10.5888/pcd17.200012. PMID: 32886060. **- Other: Intervention"not clearly reported**
171. Paul L, Renfrew L, Freeman J, et al. Web-based physiotherapy for people affected by multiple sclerosis: a single blind, randomized controlled feasibility study. Clin Rehabil. 2019 Mar;33(3):473-84. doi: 10.1177/0269215518817080. PMID: 30514108. **- Study of remotely delivered, non-synchronous medical services**
172. Pearl J, Safir I, Gerhard R, et al. Tele-urology versus face-to-face clinics: A survey of patient preference. Journal of Urology. 2016;195(4):e421-e2. **- Conference, meeting, poster abstract only**
173. Peterson CM, Apolzan JW, Wright C, et al. Video chat technology to remotely quantify dietary, supplement and medication adherence in clinical trials. Br J Nutr. 2016 Nov;116(9):1646-55. doi: 10.1017/s0007114516003524. PMID: 27753427. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**
174. Pfeifer MP, Keeney C, Bumpous J, et al. Impact of a telehealth intervention on quality of life and symptom distress in patients with head and neck cancer. The Journal of community and supportive oncology. 2015;13(1):14-21. doi: 10.12788/jcso.0101. PMID: CN-01072822. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**
175. Phang KF, Santosa A, Low BPL, et al. A nurse-led, rheumatologist-assisted telemedicine intervention for dose escalation of urate-lowering therapy in gout. Int J Rheum Dis. 2020 Aug;23(9):1136-44. doi: 10.1111/1756-185x.13855. PMID: 32483906. **- Audio only visits**
176. Pinto R, Pires ML, Borges M, et al. Digital home-based multidisciplinary cardiac rehabilitation: How to counteract physical inactivity during the COVID-19 pandemic. Rev Port Cardiol. 2022 Mar;41(3):209-18. doi: 10.1016/j.repc.2021.05.013. PMID: 34840415. **- Non-USA based study or does not report data separately for USA**
177. Piotrowicz E, Korzeniowska-Kubacka I, Chrapowicka A, et al. Feasibility of home-based cardiac telerehabilitation: Results of TeleInterMed study. Cardiol J.

2014;21(5):539-46. doi: 10.5603/CJ.a2014.0005. PMID: 24526507. **- Study of remotely delivered, non-synchronous medical services**

178. Porath A, Irony A, Borobick AS, et al. Maccabi proactive Telecare Center for chronic conditions - the care of frail elderly patients. Isr J Health Policy Res. 2017 Dec 11;6(1):68. doi: 10.1186/s13584-017-0192-x. PMID: 29228992. **- Non-USA based study or does not report data separately for USA**

179. Powers JS, Abraham L, Parker R, et al. The GeriPACT Initiative to Prevent All-Cause 30-Day Readmission in High Risk Elderly. Geriatrics (Basel). 2021 Jan 6;6(1)doi: 10.3390/geriatrics6010004. PMID: 33418873. **- Other: Does not report numbers on quantitative outcomes**

180. Presswala L, Myers A, Bissoonauth A, et al. Usability of a home telehealth unit to improve health outcomes in black and hispanic patients with uncontrolled type 2 diabetes: an interim analysis. Endocrine reviews. 2018;39(2) PMID: CN-01620434. **- Conference, meeting, poster abstract only**

181. Quenel-Tueux N, Allam V, Desroches M, et al. E-DomSanté study on the improvement of care in oncology through digital technology. Cancer research. 2019;79(4)doi: 10.1158/15387445.SABCS18-P1-11-19. PMID: CN-01941489. **- Conference, meeting, poster abstract only**

182. Ramachandran R, Elkin Z, Brodie SE, et al. Evaluation of teleophthalmology during the COVID-19 pandemic at a single outpatient clinical practice. Investigative Ophthalmology and Visual Science. 2021;62(8). **- Conference, meeting, poster abstract only**

183. Ramakrishnan S, Dubstov D, Kaur D, et al. Safety, benefits, and efficacy of a virtual clinic for assessment of patients referred for endoscopy: A retrospective audit. Journal of Gastroenterology and Hepatology. 2021;36(SUPPL 3):182-3. doi: 10.1111/jgh.15618. **- Conference, meeting, poster abstract only**

184. Rasmussen OW, Lauszus FF, Loekke M. Telemedicine compared with standard care in type 2 diabetes mellitus: a randomized trial in an outpatient clinic. Journal of telemedicine and telecare. 2016;22(6):363-8. doi: 10.1177/1357633X15608984. PMID: CN-01402256. **- Non-USA based study or does not report data separately for USA**

185. Rassouli F, Baty F, Kohler M, et al. Telehealth vs. standard care in COPD - a randomized controlled trial. European respiratory journal. 2020;56doi: 10.1183/13993003.congress-2020.2666. PMID: CN-02230750. **- Conference, meeting, poster abstract only**

186. Rassouli F, Baty F, Stolz D, et al. Telehealth care vs. standard care in COPD - An international randomised controlled trial (interim analysis). Respiration; international review of thoracic diseases. 2018;95(6):508-. doi: 10.1159/000488898. PMID: CN-01647703. **- Conference, meeting, poster abstract only**

187. Rassouli F, Germann A, Baty F, et al. Telehealth mitigates COPD disease progression compared to standard of care: a randomized controlled crossover trial. Journal of internal medicine. 2021;289(3):404-10. doi: 10.1111/joim.13230. PMID: CN-02232348. **- Non-USA based study or does not report data separately for USA**

188. Raymond E, Chong E, Winikoff B, et al. TelAbortion: evaluation of a direct to patient telemedicine abortion service in the United States. Contraception. 2019;100(3):173-7. doi: 10.1016/j.contraception.2019.05.013. **- Does not report data for adult patients or cannot extract information separately**

189. Raymond JK, Flores Garcia J, Salcedo Rodriguez E, et al. The expansion of CoYoT1: Virtual diabetes care for the COVID-19 pandemic. Pediatric Diabetes. 2021;22(SUPPL 29):92. doi: 10.1111/pedi.13198. **- Conference, meeting, poster abstract only**

190. Reynolds SG, Baima J, Woo L, et al. Prehabilitation for shoulder dysfunction in breast cancer: a pilot study. PM and r. 2015;7(9):S179-S80. PMID: CN-01106586. **- Conference, meeting, poster abstract only**

191. Rezich BMZ, Malone JA, Reiser G, et al. Telehealth genetic services during the COVID-19 Pandemic: Implementation and patient experiences across multiple specialties in Nebraska. J Genet Couns. 2021 Oct;30(5):1233-43. doi: 10.1002/jgc4.1507. PMID: 34617357. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

192. Ringbæk T, Green A, Laursen LC, et al. Effect of tele health care on exacerbations and hospital admissions in patients with chronic obstructive pulmonary disease: a randomized clinical trial. International journal of chronic obstructive pulmonary disease. 2015;10:1801-8. doi: 10.2147/COPD.S85596. PMID: CN-01092064. **- Non-USA based study or does not report data separately for USA**

193. Roberts N, Totty J, Pinder R. Virtual patient assessment for hand fracture management: A departmental analysis of financial and clinical implications. British Journal of Surgery. 2021;108(SUPPL 2):ii102. doi: 10.1093/bjs/znab134.409. **- Non-USA based study or does not report data separately for USA**

194. Saeed M, Yen C, Ivan A, et al. Integration of novel telehealth-based program in high risk va patients; transition care intervention aiming to prevent unnecessary hospital readmissions. American journal of respiratory and critical care medicine. 2021;203(9)doi: 10.1164/ajrccm-conference.2021.203.1_MeetingAbstracts.A2852. PMID: CN-02286263. **- Conference, meeting, poster abstract only**

195. Saitoh M, Takahashi T, Morisawa T, et al. Remote Cardiac Rehabilitation in Older Cardiac Disease: A Randomized Case Series Feasibility Study. Cardiol Res. 2022 Feb;13(1):57-64. doi: 10.14740/cr1346. PMID: 35211224. **- Non-USA based study or does not report data separately for USA**

196. Salisbury C, Quigley A, Hex N, et al. Private video consultation services and the future of primary care. Journal of Medical Internet Research. 2020;22(10)doi: 10.2196/19415. **- Non-USA based study or does not report data separately for USA**

197. Sankaranarayanan J, Murante LJ, Moffett LM. A retrospective evaluation of remote pharmacist interventions in a telepharmacy service model using a conceptual framework. Telemed J E Health. 2014 Oct;20(10):893-901. doi: 10.1089/tmj.2013.0362. PMID: 24611489. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

198. Sarno D, Kurz JL, Chin BS, et al. A functional integrative restoration (FINER) spine program: an interdisciplinary virtual care pilot study. PM and r. 2021;13:S153-S4. doi: 10.1002/pmrj.12735. PMID: CN-02357397. **- Conference, meeting, poster abstract only**

199. Schliep M, Chudy-Onwugaje K, Abutaleb A, et al. TELEmedicine for patients with inflammatory bowel disease (tele-IBD) does not improve depressive symptoms or general quality of life compared with standard care at tertiary referral centers. Crohn's and Colitis 360. 2020;2(1)doi: 10.1093/crocol/otaa002. PMID: CN-02161979. **- Study of remotely delivered, non-synchronous medical services**

200. Schmidt S, Streltzov N, Zhao W, et al. Advantages of face-to-face contact versus video conferencing in the delivery of a selfmanagement program for people with epilepsy. Neurology. 2020;94(15) PMID: CN-02195108. **- Conference, meeting, poster abstract only**

201. Schwartz H, Har-Nir I, Wenhoda T, et al. Staying physically active during the COVID-19 quarantine: exploring the feasibility of live, online, group training sessions among older adults. Transl Behav Med. 2021 Mar 16;11(2):314-22. doi: 10.1093/tbm/ibaa141. PMID: 33447852. **- Non-USA based study or does not report data separately for USA**

202. Scott DM, Friesner DL, Rathke AM, et al. Differences in medication errors between central and remote site telepharmacies. J Am Pharm Assoc (2003). 2012 Sep-Oct;52(5):e97-e104. doi: 10.1331/JAPhA.2012.11119. PMID: 23023864. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

203. Scott DM, Friesner DL, Rathke AM, et al. Medication error reporting in rural critical access hospitals in the North Dakota Telepharmacy Project. Am J Health Syst Pharm. 2014 Jan 1;71(1):58-67. doi: 10.2146/ajhp120533. PMID: 24352183. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

204. Seghers AC, Seng KH, Chio MT, et al. A prospective study on the use of teledermatology in psychiatric patients with chronic skin diseases. Australas J Dermatol. 2015 Aug;56(3):170-4. doi: 10.1111/ajd.12297. PMID: 25754857. **- Non-USA based study or does not report data separately for USA**

205. Sept L, Kirkwood J, Korownyk CS. Virtual versus in-person primary care visits. Canadian Family Physician. 2020;66(12):904. doi: 10.46747/cfp.6612904. **- Non-USA based study or does not report data separately for USA**

206. Shamim-Uzzaman QA, Bae CJ, Ehsan Z, et al. The use of telemedicine for the diagnosis and treatment of sleep disorders: An American Academy of Sleep Medicine update. Journal of Clinical Sleep Medicine. 2021;17(5):1103-7. doi: 10.5664/jcsm.9194. **- No original data (opinion, descriptive data, letters, editorial, commentary, protocols)**

207. Siwy KG. Telehealth in burn rehabilitation: Virtual objective measures. Journal of Burn Care and Research. 2021;42(SUPPL 1):S180. doi: 10.1093/jbcr/irab032.296. **- Conference, meeting, poster abstract only**

208. Smith SW, Tiu J, Caspers CG, et al. Virtual Urgent Care Quality and Safety in the Time of Coronavirus. Jt Comm J Qual Patient Saf. 2021 Feb;47(2):86-98. doi: 10.1016/j.jcjq.2020.10.001. PMID: 33358323. **- Includes only patients receiving in-patient or emergency department care**

209. So H, Chow E, Cheng IT, et al. Use of telemedicine for follow-up of lupus nephritis in the COVID-19 outbreak: The 6-month results of a randomized controlled trial. Lupus. 2022;31(4):488-94. doi: 10.1177/09612033221084515. PMID: CN-02375963. **- Non-USA based study or does not report data separately for USA**

210. So H, Chow E, Li TK, et al. Use of telemedicine for followup of SLE patients with nephritis in the COVID-19 outbreak ("telesle"): the 6-month results of a randomized controlled trial. Annals of the rheumatic diseases. 2021;80(SUPPL 1):860-1. doi: 10.1136/annrheumdis-2021-eular.580. PMID: CN-02303738. **- Non-USA based study or does not report data separately for USA**

211. Solle JC, Wickham SK, Tierney J, et al. Adapting Virtual Care in a Global Pandemic: Telemedicine As a Useful Alternative in Clinical Practice in the Stem Cell Transplant Program at Dana-Farber Cancer Institute. Transplantation and Cellular Therapy. 2021;27(3):S94-S5. doi: 10.1016/S2666-6367(21)00124-X. **- No original data (opinion, descriptive data, letters, editorial, commentary, protocols)**

212. Spindler M, Hummel E, Pawlowski S, et al. Telehealth in the parkinson's disease subspecialty clinic: the key to the patient-centered medical home. Neurology. 2014;82(10) PMID: CN-01010462. **- Conference, meeting, poster abstract only**

213. Staller K, Paz M, Rones R, et al. Virtual Tai Chi program for patients with irritable bowel syndrome with constipation: Proof-of-concept feasibility trial. Neurogastroenterology and Motility. 2022doi: 10.1111/nmo.14429. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

214. Summerfelt WT, Sulo S, Robinson A, et al. Scalable hospital at home with virtual physician visits: pilot study. Am J Manag Care. 2015 Oct;21(10):675-84. PMID: 26633092. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

215. Szalewska D, Główczyńska R, Piotrowicz R, et al. An aetiology-based subanalysis of the Telerehabilitation in Heart Failure Patients (TELEREH-HF) trial. ESC heart failure. 2021;8(2):1263-73. doi: 10.1002/ehf2.13189. PMID: CN-02247982. **- Non-USA based study or does not report data separately for USA**

216. Taetzsch A, Gilhooly CH, Bukhari A, et al. Development of a Videoconference-Adapted Version of the Community Diabetes Prevention Program, and Comparison of Weight Loss With In-Person Program Delivery. Military medicine. 2019;184(11-12):647-52. doi: 10.1093/milmed/usz069. PMID: CN-02133438. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

217. Taguchi K, Numata N, Takanashi R, et al. Clinical Effectiveness and Cost-effectiveness of Videoconference-Based Integrated Cognitive Behavioral Therapy for Chronic Pain: Randomized Controlled Trial. Journal of medical Internet research. 2021;23(11):e30690. doi: 10.2196/30690. PMID: CN-02347185. **- Non-USA based study or does not report data separately for USA**

218. Taylor-Gjevre R, Nair B, Bath B, et al. Addressing rural and remote access disparities for patients with inflammatory arthritis through video-conferencing and innovative inter-professional care models. Musculoskeletal care. 2018;16(1):90-5. doi: 10.1002/msc.1215. PMID: CN-01665672. **- Non-USA based study or does not report data separately for USA**

219. Téot L, Geri C, Lano J, et al. Complex Wound Healing Outcomes for Outpatients Receiving Care via Telemedicine, Home Health, or Wound Clinic: A Randomized Controlled Trial. International Journal of Lower Extremity Wounds. 2020;19(2):197-204. doi: 10.1177/1534734619894485. **- Non-USA based study or does not report data separately for USA**

220. Truter P, Russell T, Fary R. The validity of physical therapy assessment of low back pain via telerehabilitation in a clinical setting. Telemed J E Health. 2014 Feb;20(2):161-7. doi: 10.1089/tmj.2013.0088. PMID: 24283249. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

221. Tsai LL, McNamara RJ, Moddel C, et al. Home-based telerehabilitation via real-time videoconferencing improves endurance exercise capacity in patients with COPD: the randomized controlled TeleR Study. Respirology (Carlton, Vic.). 2017;22(4):699-707. doi: 10.1111/resp.12966. PMID: CN-01262193. **- Non-USA based study or does not report data separately for USA**

222. Upadhyay UD, Koenig LR, Meckstroth KR. Safety and Efficacy of Telehealth Medication Abortions in the US During the COVID-19 Pandemic. JAMA Netw Open. 2021 Aug 2;4(8):e2122320. doi: 10.1001/jamanetworkopen.2021.22320. PMID: 34427682. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

223. Valentine SE, Fuchs C, Godfrey L, et al. Redesign of a brief PTSD treatment in safety net integrated primary care: Supporting implementation in the context of the COVID-19

pandemic. General Hospital Psychiatry. 2022;74:94-101. doi: 10.1016/j.genhosppsych.2021.12.004. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

224. Van de Winckel A, Carey JR, Bisson TA, et al. Home-based transcranial direct current stimulation plus tracking training therapy in people with stroke: an open-label feasibility study. J Neuroeng Rehabil. 2018 Sep 18;15(1):83. doi: 10.1186/s12984-018-0427-2. PMID: 30227864. **- Study of remotely delivered, non-synchronous medical services**

225. Vargas BB, Shepard M, Hentz JG, et al. Feasibility and accuracy of teleconcussion for acute evaluation of suspected concussion. Neurology. 2017;88(16):1580-3. doi: 10.1212/WNL.0000000000003841. PMID: CN-01370902. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

226. Vedire K, Joselow AL, Markham CM, et al. Teledermatology-directed surgical care is safe and reduces travel. J Telemed Telecare. 2016 Mar;22(2):121-6. doi: 10.1177/1357633x15589861. PMID: 26116856. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

227. Verma N, Mishra S, Singh S, et al. Feasibility, Outcomes, and Safety of Telehepatology Services During the COVID-19 Pandemic. Hepatol Commun. 2022 Jan;6(1):65-76. doi: 10.1002/hep4.1732. PMID: 34230904. **- Non-USA based study or does not report data separately for USA**

228. Versteegden D, Van Himbeeck M, Jf S, et al. A randomized controlled trial for assessing the value of ehealth in bariatric care: 1-year-bepatient trial results. Obesity surgery. 2019;29(5):776-. doi: 10.1007/s11695-019-04101-1. PMID: CN-01988978. **- Conference, meeting, poster abstract only**

229. Viers B, Rivera M, Frank I, et al. Efficiency and satisfaction of video-visits is equivalent to an office visit: a prospective randomized controlled study in urology. Journal of urology. 2015;193(4):e259-. PMID: CN-01729117. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

230. Villani A, Malfatto G, Compare A, et al. Clinical and psychological telemonitoring and telecare of high risk heart failure patients. J Telemed Telecare. 2014 Dec;20(8):468-75. doi: 10.1177/1357633x14555644. PMID: 25339632. **- Study of remotely delivered, non-synchronous medical services**

231. Vranceanu AM, Riklin E, Merker VL, et al. Mind-body therapy via videoconferencing in patients with neurofibromatosis: an RCT. Neurology. 2016;87(8):806-14. doi: 10.1212/WNL.0000000000003005. PMID: CN-01379640. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

232. Ward EC, Sharma S, Burns C, et al. Validity of conducting clinical dysphagia assessments for patients with normal to mild cognitive impairment via telerehabilitation. Dysphagia. 2012;27(4):460-72. doi: 10.1007/s00455-011-9390-9. **- Non-USA based study or does not report data separately for USA**

233. Watts KA, Gazaway S, Malone E, et al. Community Tele-pal: a community-developed, culturally based palliative care tele-consult randomized controlled trial for African American and White Rural southern elders with a life-limiting illness. Trials. 2020;21(1)doi: 10.1186/s13063-020-04567-w. PMID: CN-02160314. **- No original data (opinion, descriptive data, letters, editorial, commentary, protocols)**

234. Whited JD, Warshaw EM, Edison KE, et al. Effect of store and forward teledermatology on quality of life: a randomized controlled trial. JAMA dermatology. 2013;149(5):584-91. doi: 10.1001/2013.jamadermatol.380. PMID: CN-00877277. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

235. Wienhold J, Mösch L, Rossaint R, et al. Teleconsultation for preoperative evaluation during the coronavirus disease 2019 pandemic: A technical and medical feasibility study. Eur J Anaesthesiol. 2021 Dec 1;38(12):1284-92. doi: 10.1097/eja.0000000000001616. PMID: 34669644. **- Non-USA based study or does not report data separately for USA**

236. Wilroy J, Lai B, Currie M, et al. Feasibility of Teleassessments for Enrollment of Adults with Physical/Mobility Disability in a Home-Based Exercise Trial in Response to COVID-19. Archives of physical medicine and rehabilitation. 2022;103(3):e17. doi: 10.1016/j.apmr.2022.01.046. PMID: CN-02392837. **- Conference, meeting, poster abstract only**

237. Woo BFY, Tam WWS, Rangpa T, et al. A Nurse-Led Integrated Chronic Care E-Enhanced Atrial Fibrillation (NICE-AF) Clinic in the Community: A Preliminary Evaluation. International Journal of Environmental Research and Public Health. 2022;19(8)doi: 10.3390/ijerph19084467. **- Non-USA based study or does not report data separately for USA**

238. Wright WL, White PA, Welsh M, et al. Evaluating the effect of COVID-19 on quality measures of patients with type 2 diabetes in two family nurse practitioner-owned clinics. J Am Assoc Nurse Pract. 2022 Sep 1;34(9):1090-7. doi: 10.1097/jxx.0000000000000768. PMID: 36044349. **- Study does not report on use of telehealth in real-time encounters between patients and clinicians**

239. Yao L, Fleshner PR, Zaghiyan KN. IMPACT OF POSTOPERATIVE TELEMEDICINE VISIT VS. IN-PERSON VISIT ON PATIENT SATISFACTION DURING THE COVID-19 PANDEMIC: a RANDOMIZED CLINICAL TRIAL. Diseases of the colon and rectum. 2022;65(5):126-7. PMID: CN-02414423. **- Conference, meeting, poster abstract only**

240. Yassa HA, Hussein AARM, Makhlouf HA, et al. Pros and cons of telemedicine in diagnosis and management: A cross sectional survey. Electronic Journal of General Medicine. 2022;19(5)doi: 10.29333/ejgm/12236. **- Non-USA based study or does not report data separately for USA**

241. Yeroushalmi S, Millan SH, Nelson K, et al. 26780 Patient experiences with teledermatology during the COVID-19 pandemic: A survey. Journal of the American

Academy of Dermatology. 2021;85(3):AB116. doi: 10.1016/j.jaad.2021.06.483. **- Conference, meeting, poster abstract only**

242. Yeroushalmi S, Millan SH, Nelson K, et al. Patient Perceptions and Satisfaction With Teledermatology During the COVID-19 Pandemic: A Survey-Based Study. J Drugs Dermatol. 2021 Feb 1;20(2):178-83. doi: 10.36849/jdd.5714. PMID: 33538563. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

243. Yip A, Chong L, Lee A, et al. Telemedicine versus in-person follow-up after uncomplicated, benign general surgical procedures. British Journal of Surgery. 2020;107(SUPPL 4):45. doi: 10.1002/bjs.12068. **- Non-USA based study or does not report data separately for USA**

244. Zhao M, Qin D, Cataldo G, et al. Virtual multidisciplinary care for heart failure patients with cardiac resynchronization therapy devices during the Coronavirus Disease 2019 pandemic. Int J Cardiol Heart Vasc. 2021 Jun;34:100811. doi: 10.1016/j.ijcha.2021.100811. PMID: 34095452. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

245. Ziemba SJ, Bradley NS, Landry LA, et al. Posttraumatic stress disorder treatment for Operation Enduring Freedom/Operation Iraqi Freedom combat veterans through a civilian community-based telemedicine network. Telemedicine journal and e-health. 2014;20(5):446-50. doi: 10.1089/tmj.2013.0312. PMID: CN-01117927. **- Does not report on any outcomes, harms, safety measures, or safety indicators**

# Appendix C. Evidence Tables

**Evidence Table C-1. Study characteristics of studies addressing harms from patient-clinician real-time clinical encounters using telehealth**

| Author, year | KQ | Purpose | Study | Study Dates (m/d/y) | Study Design | Telehealth Intervention | Comparator | Intervention Duration |
|---|---|---|---|---|---|---|---|---|
| Afshari, 2021[15] | KQ1 | To determine if the telehealth application of two observer-based, objective measures of fall-risk in PD—Five-Times-Sit-To-Stand (FTSTS) and 360 Rapid-Turns-Test (RTT)—is feasible and safe | Study name: NR<br>Main study: NR | NR | Feasibility study | All participants had an initial in-person clinic evaluation, followed by four televisits every 2 weeks and then a final in-person visit. Televisits were performed on the HIPAA compliant secure VidyoConnect Epic platform. Participants used their own or a loaned Apple iPad and connected to their home WiFi to participate in televisits. At the baseline in-person visit, the study physical therapist demonstrated the FTSTS and RTT measures and obtained baseline scores. Participants learned how to execute measures at home, and care partners were instructed on stand-by assistance measures. | NR | 10 Week |

| Author, year | KQ | Purpose | Study | Study Dates (m/d/y) | Study Design | Telehealth Intervention | Comparator | Intervention Duration |
|---|---|---|---|---|---|---|---|---|
| Bednarski, 2019[28] | KQ1 | To determine whether the combination of MIS, ERP and a structured telemedicine program (TeleRecovery) could shorten total 30-day LOS by 50 per cent | Study name: RecoverMI Main study: Phase II of RecoverMI | 1/7/2016 to 8/22/2017 | RCT | Accelerated discharge on postoperative day (POD) 1 with or without evidence of bowel function and a teleVideo-conference on POD-2. Physician assistants within the colonic and rectal surgery section at MDACC conducted the teleVideo-conferences. | Routine postoperative management care | NR |
| Blyler, 2021[16] | KQ1 | Tested whether virtual visits could be substituted for in-person visits after blood pressure (BP) control was achieved. | Study name: NR Main study: Los Angeles Barbershop Blood pressure Study | NR | Prospective cohort | Participants' barbers promoted follow-up with a specialty-trained pharmacist who initially met each patron in the barbershop for bimonthly in-person visits. Once BP goal of ≤130/80 mmsHg achieved, participants were transitioned to monthly virtual visits, connecting with the pharmacist via WebEx, Facetime, or stand-alone BP monitors housed in the barbershops. | No comparator | NR |
| Chu, 2015[35] | KQ1 | To report the use of telemedicine to deliver general urologic care to remote locations within the Veterans Affairs Greater Los Angeles Healthcare System. | Study name: NR Main study: NR | 9/1/2013 to 3/1/2014 | Retrospective cohort | Conducted telemedicine visits 9 half-days per month via a videoconferencing system over a virtual local area network between tertiary medical center and 2 outpatient primary care clinics. | No comparator | 9.5 Day |

| Author, year | KQ | Purpose | Study | Study Dates (m/d/y) | Study Design | Telehealth Intervention | Comparator | Intervention Duration |
|---|---|---|---|---|---|---|---|---|
| Delman, 2021[34] | KQ1 | To report our center's (University of Cincinnati Medical Center, Cincinnati, OH) protocolized response to the COVID-19 pandemic | Study name: NR<br>Main study: NR | 3/1/2020 to 8/1/2020 | Prospective cohort | COVID-19 era: virtual selection meetings, coronavirus disease 2019 negative donors, pretransplant symptom screening, rapid testing on presentation, telehealth follow-up, and weekly community outreach town halls. | Pre-COVID-19 era: usual care | NR |
| Gonzalez, 2021[14] | KQ1 | To examine the efficacy of improving medication safety through a pharmacist-led, mobile health–based intervention. | Study name: NR<br>Main study: NR | NR | RCT | Received clinical pharmacist–led supplemental medication therapy monitoring and management, utilizing a smartphone-enabled mobile health app, with risk-driven televisits and home-based BP and blood glucose monitoring. | Usual care | 12 Month |
| Grossman, 2017[17] | KQ1, KQ2 | To compare the proportion of medical termination of pregnancy with a clinically significant adverse event among telemedicine and in-person patients at a clinic system in Iowa during the first 7 years of the service | Study name: NR<br>Main study: NR | 7/1/2008 to 6/30/2015 | Retrospective cohort | Video discussion with patients, and if eligible for a medical termination of pregnancy, mifepristone and misoprostol are remotely dispensed. | In-person medical termination of pregnancy services | NR |

| Author, year | KQ | Purpose | Study | Study Dates (m/d/y) | Study Design | Telehealth Intervention | Comparator | Intervention Duration |
|---|---|---|---|---|---|---|---|---|
| Harkey, 2021[32] | KQ1 | To evaluate the outcomes of all-cause 30-day hospital encounter proportion among patients who have a post-discharge video-based virtual visit follow-up compared with in-person follow-up. | Study name: NR<br>Main study: NR | 8/1/2017 to 3/1/2020 | RCT | Completing a video-based visit with the certified medical assistant who confirmed patient location, identification, and reviewed demographics and home medications. Patients were then placed in the virtual waiting room until the surgery team member picked them up and a separate video-based virtual visit was performed. | In-person visits | NR |
| Hickey, 2017[33] | KQ1 | The objective of this study is to review our experience incorporating Interactive Home Telehealth (IHT) visits into follow-up burn care | Study name: NR<br>Main study: NR | 3/1/2015 to 6/1/2016 | Retrospective cohort | Typical encounters included a brief follow-up discussion, with a review of any changes in clinical status, as well as a problem focused video-directed virtual physical exam. Changes to the outpatient burn plan of care were communicated directly to the patient. | NR | 15 Month |
| Hidecker, 2022[18] | KQ1, | This study aimed to test the feasibility, safety, and signal of efficacy of a coordinated telehealth program, consisting of speech therapy, physiotherapy, and pharmaceutical care, for people with PD living in some rural US communities. | Study name: NR<br>Main study: NR | 11/1/2017 to 12/1/2018 | Prospective cohort | 8-week telehealth program, consisting of speech therapy, physiotherapy, and pharmaceutical care, using a single cohort of people with PD living in rural Wyoming and Nevada, USA. | Patients at Baseline | 8 Week |

| Author, year | KQ | Purpose | Study | Study Dates (m/d/y) | Study Design | Telehealth Intervention | Comparator | Intervention Duration |
|---|---|---|---|---|---|---|---|---|
| Jackson, 2012[19] | KQ1 | To overcome the current reality in which patients receive inadequate rehabilitation, we devised a multi-faceted, in-home tele-rehabilitation program implemented using social workers and psychology technicians with the goal of improving cognitive and functional outcomes. | Study name: The Returning to Everyday Tasks Utilizing Rehabilitation Networks (RETURN) Study<br>Main study: NIA-sponsored BRAIN-ICU cohort | 8/1/2008 to 2/1/2009 | RCT | The comprehensive, multicomponent, in-home rehabilitation program delivered to the intervention patients was developed with a specific focus on the remediation of characteristic deficits among ICU survivors (i.e., limitations in cognition, strength and endurance, and functional ability). | In-person care | 3 Month |
| John, 2020[20] | KQ1 | We investigated the effects of telehealth on the liver transplant evaluation process. | Study name: NR<br>Main study: NR | 1/1/2005 to 12/31/2017 | Retrospective cohort | The telehealth visit with the transplant hepatologist included a detailed history of the patient's liver disease, co-morbidities, social history particularly substance abuse and social support, counseling about the transplant listing process, waiting list, MELD scores, transplant procedure, immunosuppression, complications and posttransplant outcomes. | In-person (usual care) | NR |

| Author, year | KQ | Purpose | Study | Study Dates (m/d/y) | Study Design | Telehealth Intervention | Comparator | Intervention Duration |
|---|---|---|---|---|---|---|---|---|
| Keteyian, 2021[21] | KQ1 | To compare exercise training intensity during standard cardiac rehabilitation (S-CR) versus Hybrid-CR (combined clinic- and remote home-/community-based). | Study name: iATTEND Main study: Phase II of iATTEND | 3/1/2019 to 3/1/2020 | RCT | Were asked to complete ≥ 1 and ≤ 12 of their 18 sessions in the CR clinic facility, with the remaining sessions completed remotely at-home or in the community using telehealth. | Completed all sessions in the hospital's early-outpatient Phase II, clinic-based program. | NR |
| Levine, 2022[22] | KQ1, KQ2 | To compare remote and in-person [hospital at] home physician care | Study name: NR Main study: NR | 8/3/2019 to 3/26/2020 | RCT | Video visit daily after initial in- home visit (physician had option to see in home again as needed). | In-home visit by physician daily | NR |
| Luxton, 2015[23] | KQ1, | The purpose of this preliminary study was to evaluate the feasibility and safety of providing U.S. military service members with a behavioral health treatment delivered directly to the home using videoconferencing | Study name: Main study: NR | NR | Feasibility study | A behavioral activation (BA) treatment for PTSD8 delivered via synchronous (two-way) videoconferencing to the homes of U.S. military service members. | Patients at Baseline | NR |
| Luxton, 2016[24] | KQ1 | The purpose of this randomized controlled noninferiority trial was to compare the safety, feasibility, and effectiveness of home-based telebehavioral health to care provided in the traditional in-office setting among military personnel and veterans. | Study name: NR Main study: NR | 8/1/2012 to NR | RCT | 8 sessions of behavioral activation treatment for depression (BATD) in the home via videoconferencing. | 8 sessions of behavioral activation treatment for depression in a traditional office (same room) setting | 8 Week |

| Author, year | KQ | Purpose | Study | Study Dates (m/d/y) | Study Design | Telehealth Intervention | Comparator | Intervention Duration |
|---|---|---|---|---|---|---|---|---|
| Nikolian, 2018[25] | KQ1, KQ2 | This pilot study was performed to investigate the safety, feasibility, and financial implications of providing postoperative care using an electronic clinic (eClinic) at a university hospital | Study name: NR<br>Main study: NR | 3/1/2017 to 1/1/2018 | Prospective cohort | 2 week postoperative visit was conducted using telehealth (video). | 2 week postoperative visit was conducted in person (traditional) | 2 Week |
| Noel, 2020[29] | KQ1 | Evaluated Telehealth feasibility in improving transitions of care. | Study name: Telehealth Transitions of Care<br>Main study: NR | 6/1/2017 to 6/1/2018 | RCT | Provision of a telehealth kit,. Telehealth patients measured their vitals daily using the tele-equipment and had weekly virtual visits with a transition of care physician (teledoc). | Standard transitions of care | NR |
| Olden, 2017[26] | KQ1 | Investigate the feasibility of conducting a research trial with exposure therapy delivered via videoconferencing. | Study name: NR<br>Main study: NR | NR | Prospective cohort | 12–15 session exposure therapy protocol conducted weekly in 1.5 hour sessions through video-conferencing. | No comparator | 15 Week |
| Sherwood, 2019[36] | KQ1, | We reviewed the safety and effectiveness of our hospital's urologic telemedicine (TM) program that has been utilized for the Iowa prisoner population for over a decade. | Study name: NR<br>Main study: NR | 6/1/2007 to 7/1/2014 | Retrospective cohort | urologic complaints provided to the APP, the eventual diagnosis (or differential diagnosis) provided by the APP to the patient, management suggested including diagnostic tests ordered, medications and/or treatments provided, and suggested follow-up. | In-person visit | NR |

| Author, year | KQ | Purpose | Study | Study Dates (m/d/y) | Study Design | Telehealth Intervention | Comparator | Intervention Duration |
|---|---|---|---|---|---|---|---|---|
| Shirley, 2021[31] | KQ1 | To pilot a pharmacist-integrated palliative care team clinic utilizing telemedicine to optimize palliative prescribing for Veterans and to describe CPS outcomes related to pharmacotherapy changes implemented | Study name: NR<br>Main study: NR | 12/1/2019 to 5/31/2020 | Prospective cohort | The palliative care CPS completed a comprehensive medication regimen review, assessed symptoms, addressed medication-related concerns, evaluated medication compliance, and provided medication education. They also utilized the VA's VIONE deprescribing tool to identify potentially inappropriate medications and make deprescribing recommendations. | No comparator | NR |
| Tham, 2021[30] | KQ1 | To determine the impact of postoperative telehealth visits (PTV) on reducing emergency department visits (EDV) and readmissions within 30 days post-discharge (30DR). | Study name: NR<br>Main study: NR | 9/1/2017 to 7/1/2019 | Retrospective cohort | Postoperative telehealth visits are scheduled by the institution's telehealth department within 72 hours post-discharge. | Usual care without post-operative telehealth visit | NR |
| Tönnies, 2021[27] | KQ1 | The study aims to evaluate the feasibility of mental health specialist video consultations with primary care patients with depression or anxiety disorders. | Study name: NR<br>Main study: PROVIDE-B | 3/1/2017 to 10/1/2017 | RCT | Web-based, real-time video consultations involving a 2-way interactive video to a primary care practice between mental health specialists and patients for up to 5 sessions. | Treatment-as-usual | 2 Week |

APP = advanced practice provider; BA = beahvioral activation; BATD = behavioral activation treatment for depression; BP = blood pressure; BRAIN-ICU = Bringing to Light the Risk Factors and Incidence of Neuropsychological Dysfunction in intensive care unit; CPS = clinical pharmacy specialists; CR = cardiac rehabilitation; d = day; EDV = emergency department visits; ERP = enhanced recovery protocols; FTSTS = Five-Times-Sit-To-Stand; HIPAA = Health Insurance Portability and Accountability Act; iATTEND = improving

ATTENDance to cardiac rehabilitation; ICU = intensive care unit; IHT = Interactive Home Telehealth; KQ = Key Question; LOS = length of stay; m = month; MDACC = University of Texas MD Anderson Cancer Center; MELD = Model of End Stage Liver Disease; MIS = minimally invasive surgery; mmHg = millimeters of mercury; NIA = National Institute of Aging; NR = not reported; PD = Parkinson's disease; POD = postoperative day; PROVIDE-B = improving cross-sectoral collaboration between primary and psychosocial care: an implementation; PTV = postoperative telehealth visits; RCT = randomized controlled trial; RTT = Rapid Turns Test; S-CR = standard cardiac rehabilitation; study on video consultations-B; TM = telemedicine; VA = United States Department of Veterans Affairs; VIONE = Vital, Important, Optional, Not needed, Every medication has an indication program; y = year

**Evidence Table C-2. Patient condition and geographic location of studies addressing harms from patient-clinician real-time clinical encounters using telehealth**

| Author, year | Specific Patient Condition | Patient Safety Practice Description | Patient Location | Clinical Focus | Patient Required To Be in State | Geographic Location |
|---|---|---|---|---|---|---|
| Afshari, 2021[15] | Specific condition: Parkinson Disease<br>Specific population: Patients identified as likely to benefit from PT and OT to reduce fall-risk | None | Home<br>Community type: NR | Physical Therapist | Yes | Illinois |
| Bednarski, 2019[28] | Specific condition: Colonic or rectal cancer<br>Specific population: Colonic or rectal cancer patients | None | Home or hotel<br>Community type: NR | Physician assistant | Yes | Texas |
| Blyler, 2021[16] | Specific condition: Stage 2 hypertension (systolic BP ≥140 mm Hg)<br>Specific population: Black men | None | Home<br>Community type: Urban | pharmacists | Yes | California |
| Chu, 2015[35] | Specific condition: Urology patients<br>Specific population: Veterans | None | Outpatient care center<br>Community type: Rural | Urologists | Yes | California |
| Delman, 2021[34] | Specific condition: Orthotopic liver transplantation<br>Specific population: Transplant waitlisted patients | Safety culture, clinical decision support, teamwork and team training | Not specified, assuming Home<br>Community type: NR | Surgical | Unclear | Ohio |
| Gonzalez, 2021[14] | Specific condition: Kidney transplantation<br>Specific population: Kidney transplant patients | None | Home<br>Community type: NR | pharmacists | Unclear | NR |
| Grossman, 2017[17] | Specific condition: Termination of pregnancy<br>Specific population: Pregnant women | None | Home<br>Community type: NR | Primary care | Yes | Montana |

| Author, year | Specific Patient Condition | Patient Safety Practice Description | Patient Location | Clinical Focus | Patient Required To Be in State | Geographic Location |
|---|---|---|---|---|---|---|
| Harkey, 2021[32] | Specific condition: Appendectomy and cholecystectomy<br>Specific population: Post-operative patients | None | Home<br>Community type: NR | Surgical | Yes | North Carolina, South Carolina |
| Hickey, 2017[33] | Specific condition: Burn Victims<br>Specific population: Patients discharged from an inpatient admission or the emergency department with barriers to follow-up such as distance from hospital on discharge, inability to drive or obtain a driver, or significant comorbidities that made traveling difficult, were offered an IHT encounter | None | Home<br>Community type: NR | Burn Surgeons, Physiatrists & Psychiatrists | Unclear | NR |
| Hidecker, 2022[18] | Specific condition: Parkinson Disease<br>Specific population: NR | None | Home<br>Community type: Rural | Speech-language pathologist; physio-therapist; clinical pharmacist | Unclear | NR |
| Jackson, 2012[19] | Specific condition: Not specified<br>Specific population: Patients discharged from medical intensive care unit (MICU) or surgical intensive care unit SICU | None | Home<br>Community type: NR | Social workers and psychology technicians | Unclear | NR |
| John, 2020[20] | Specific condition: Liver transplantation<br>Specific population: Liver transplant candidates | None | Veterans Associate Medical Center<br>Community type: NR | Transplant hepatologist | No | USA (across 29 states) |
| Keteyian, 2021[21] | Specific condition: Cardiac rehabilitation patients<br>Specific population: Cardiac rehabilitation patients | None | Home<br>Community type: NR | Cardiac rehabilitation staff | Yes | Michigan |
| Levine, 2022[22] | Specific condition: Infection, Heart Failure, COPD, Asthma, cellulitis OPD,malignant pain etc,<br>Specific population: Patients who are home-health subscribers | None | Home<br>Community type: NR | Presumably Hospitalists | Yes | Massachusetts |
| Luxton, 2015[23] | Specific condition: Post-Traumatic Stress Disorder (PTSD)<br>Specific population: Enlisted members of U.S. Army | None | Home<br>Community type: NR | Psychologist, postdoctoral fellow | Unclear | NR |

| Author, year | Specific Patient Condition | Patient Safety Practice Description | Patient Location | Clinical Focus | Patient Required To Be in State | Geographic Location |
|---|---|---|---|---|---|---|
| Luxton, 2016[24] | Specific condition: Depression<br>Specific population: US military personnel | None | Home Community type: NR | Mental health | Yes | Washington, Oregon |
| Nikolian, 2018[25] | Specific condition: laparoscopic cholecystectomy, appendectomy, ventral/umbilical hernia repair (open or laparoscopic), Inguinal hernia repair (open or laparoscopic<br>Specific population: Post-operative patients | None | Home Community type: NR | Surgical | No | Michigan and surrounding states (not specified) Patients in surrounding States to Michigan were included in study (not quantified) |
| Noel, 2020[29] | Specific condition: Not specified<br>Specific population: Patients with two or more chronic conditions | None | Home Community type: NR | Primary care | Yes | New York |
| Olden, 2017[26] | Specific condition: PTSD<br>Specific population: Survivors of trauma resulting from working in an occupation at risk for PTSD | None | Home Community type: NR | Mental health | Yes | Vermont |
| Sherwood, 2019[36] | Specific condition: Urologic complaints/conditions<br>Specific population: Prisoners | None | Prison Community type: Rural | Urologic advanced practice provider (APP) | Yes | Iowa |
| Shirley, 2021[31] | Specific condition: Cancer Patients<br>Specific population: Veterans | De-prescription | Home Community type: NR | Palliative Care Physicians | Unclear | NR |
| Tham, 2021[30] | Specific condition: Thoracic surgery patients<br>Specific population: Thoracic surgery patients | None | Home Community type: NR | Surgical | Unclear | NR |
| Tönnies, 2021[27] | Specific condition: Primary care<br>Specific population: Patients with depression or anxiety disorder | None | Home Community type: NR | Mental health | Not applicable (Germany) | NR |

BP = blood pressure; COPD = chronic obstructive pulmonary disease; IHT = Interactive Home Telehealth; MICU = medical intensive care unit; mmHg = millimeters of mercury; NR = not reported; OPD = obstructive pulmonary disease; OT = tele-occupational therapy; PT = tele-physical therapy; PTSD = post-traumatic stress disorder; SICU = surgical intensive care unit

**Evidence Table C-3. Patient characteristics of studies addressing harms from patient-clinician real-time clinical encounters using telehealth**

| Author, Year | Arm | Arm Name | N at Baseline | Gender | Age | Race |
|---|---|---|---|---|---|---|
| Afshari, 2017[15] | Overall | Telemedicine | 15 | Female: 5 (33.3)<br>Male: 10 (66.7) | Mean: NR (SD NR)<br>Median: 67 (IQR 64-73)<br>Range: 60-73 | White: 11 (73.3)<br>Black or African American: 1 (6.7)<br>Asian: 3 (20) |
| Bednarski, 2019[28] | Arm 1 | Control | 16 | Female: 6 (37.5)<br>Male: 10 (62.5) | Mean: 59.3 (SD 10.2)<br>Median: NR<br>Range: NR | White: 10 (62.5) |
| Bednarski, 2019[28] | Arm 2 | RecoverMI | 14 | Female: 8 (51.14)<br>Male: 6 (42.86) | Mean: 58.7 (SD 12.6)<br>Median: NR<br>Range: NR | White: 10 (71.43) |
| Blyler, 2021[16] | Overall | Overall | 10 | Female: NR<br>Male: 10 (100) | Mean: 57.3 (SD 5.9)<br>Median: NR<br>Range: NR | Black or African American: 10 (100) |
| Chu, 2015[35] | Overall | Overall | 97 | Female: NR<br>Male: 97 (100) | Mean: 65.8 (SD NR)<br>Median: NR<br>Range: 29-90 | White: 78 (80)<br>Black or African American: 3 (3)<br>Other (Hispanic, Native American, Unknown): 16 (17) |
| Delman, 2021[34] | Arm 1 | Pre-COVID-19 | 274 | Female: 105 (38.3)<br>Male: NR (NR) | Mean: 53.2 (SD 17.1)<br>Median: NR<br>Range: NR | Non-Hispanic-White: 251 (91.6)<br>Black or African American: 13 (4.7) |
| Delman, 2021[34] | Arm 2 | COVID-19 | 70 | Female: 20 (29)<br>Male: NR | Mean: 56.2 (SD 10.9)<br>Median: NR<br>Range: NR | Non-Hispanic-White: 63 (91.3)<br>Black or African American: 6 (8.7) |
| Gonzalez, 2021[14] | Overall | Overall | 136 | Female: 59 (43)<br>Male: 77 (57) | Mean: 51 (SD 13)<br>Median: NR<br>Range: NR | White: 46 (34)<br>Black or African American: 87 (64)<br>Other (Hispanic): 3 (2) |
| Gonzalez, 2021[14] | Arm 1 | Usual care | 68 | Female: 26 (38)<br>Male: 42 (62) | Mean: 51 (SD 14)<br>Median: NR<br>Range: NR | White: 19 (28)<br>Black or African American: 47 (69)<br>Other (Hispanic): 2 (3) |
| Gonzalez, 2021[14] | Arm 2 | Intervention (mobile app/televisit) | 68 | Female: 33 (49)<br>Male: 35 (52) | Mean: 50 (SD 12)<br>Median: NR<br>Range: NR | White: 27 (40)<br>Black or African American: 40 (59)<br>Other (Hispanic): 1 (2) |

| Author, Year | Arm | Arm Name | N at Baseline | Gender | Age | Race |
|---|---|---|---|---|---|---|
| Grossman, 2017[17] | Arm 1 | In-Person | 10405 | NR | NR | NR |
| Grossman, 2017[17] | Arm 2 | Telemedicine | 8765 | NR | NR | NR |
| Harkey, 2021[32] | Arm 1 | In-Person | 143 | Female: 89 (62)<br>Male: 53 (38) | Mean: 37.4 (SD 14.4)<br>Median: NR<br>Range: NR | White: 72 (54)<br>Black or African American: 58 (44)<br>Other (Not specified): 3 (2) |
| Harkey, 2021[32] | Arm 2 | Virtual visit | 289 | Female: 186 (64)<br>Male: 103 (36) | Mean: 38.4 (SD 14)<br>Median: NR<br>Range: NR | White: 167 (64)<br>Black or African American: 84 (32)<br>Other (Not specified): 12 (4) |
| Hickey, 2017[33] | Overall | Interactive Home Telehealth (IHT) | 31 | Female: 4 (12.9)<br>Male: 27 (87.09) | Mean: 44 (SD NR)<br>Median: NR<br>Range: 18-83 | NR |
| Hidecker, 2022[18] | Overall | Telemedicine | 15 | Female: 8 (47.06)<br>Male: 7 (41.18) | Mean: 73.3 (SD NR)<br>Median: NR<br>Range: 57-93 | NR |
| Jackson, 2012[19] | Arm 1 | In-person usual care | 90 | Female: 5 (62)<br>Male: 3 (38) | Mean: 50 (SD NR)<br>Median: NR<br>Range: 46-69 | White: 7 (88)<br>Black or African American: 1 (12) |
| Jackson, 2012[19] | Arm 2 | Telemedicine | 90 | Female: 5 (38)<br>Male: 8 (62) | Mean: 47 (SD NR)<br>Median: NR<br>Range: 41-59 | White: 6 (86)<br>Black or African American: 1 (14) |
| John, 2020[20] | Arm 1 | In-person evaluation | 465 | Female: 10 (4.29)<br>Male: 223 (95.7) | Mean: NR<br>Median: 57 (IQR 7)<br>Range: NR | White: 146 (62.66)<br>Black or African American: 42 (18.03)<br>Other (Hispanic, Other): 37 (15.88) |

| Author, Year | Arm | Arm Name | N at Baseline | Gender | Age | Race |
|---|---|---|---|---|---|---|
| John, 2020[20] | Arm 2 | Teleheatlh evaluation | 465 | Female: 7 (3.02)<br>Male: 225 (96.98) | Mean: NR<br>Median: 61 (IQR 7)<br>Range: NR | White: 139 (59.91)<br>Black or African American: 59 (25.43)<br>Other (Hispanic, Other): 26 (11.4) |
| Keteyian, 2021[21] | Arm 1 | Standard cardiac rehabilitation (S-CR) | 21 | Female: NR (24)<br>Male: NR | Mean: 58 (SD 11)<br>Median: NR<br>Range: NR | White: NR (19)<br>Black or African American: NR (76)<br>Other (Not specified): NR (5) |
| Keteyian, 2021[21] | Arm 2 | Hybrid cardiac rehabilitation (Hybrid-CR) | 26 | Female: NR (35)<br>Male: NR | Mean: 63 (SD 13)<br>Median: NR<br>Range: NR | White: NR (23)<br>Black or African American: NR (73)<br>Other (Not specified): NR (4) |
| Levine, 2022[22] | Arm 1 | In-Person | 88 | Female: 46 (52.3)<br>Male: 42 (47.7) | Mean: 66.5 (SD 18.9)<br>Median: NR<br>Range: NR | Black or African American: 17 (19.5)<br>Other (Latinx): 18 (20.7)<br>White: 45 (51.7) |
| Levine, 2022[22] | Arm 2 | Telemedicine | 84 | Female: 51 (60.7)<br>Male: 33 (39.3) | Mean: 72.1 (SD 16.6)<br>Median: NR<br>Range: NR | Black or African American: 16 (19)<br>Other (Latinx): 21 (25)<br>White: 32 (38.1) |
| Luxton, 2015[23] | Overall | Telemedicine | 10 | Female: 0 (0)<br>Male: 10 (100) | Mean: 31.8 (SD 7.44)<br>Median: NR<br>Range: 21-45 | NR |
| Luxton, 2016[24] | Arm 1 | In-Person | 59 | Female: 12 (20.34)<br>Male: 47 (79.66) | Mean: NR<br>Median: NR<br>Range: 19-65 | Non-Hispanic-White: 41 (69.49)<br>Non-Hispanic-Black or African American: 10 (16.95)<br>Other (Hispanic, non-Hispanic Asian, Native American, Other): 8 (13.55) |
| Luxton, 2016[24] | Arm 2 | In-Home | 62 | Female: 10 (16.13)<br>Male: 52 (83.87) | Mean: NR<br>Median: NR<br>Range: 19-65 | Non-Hispanic-White: 44 (70.97)<br>Non-Hispanic-Black or African American: 8 (12.9)<br>Other (Hispanic, non-Hispanic Asian, Native American, Other): 10 (16.13) |

| Author, Year | Arm | Arm Name | N at Baseline | Gender | Age | Race |
|---|---|---|---|---|---|---|
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | 485 | Female: 273 (0.56)<br>Male: 212 (0.44) | Mean: 42.3 (SD 17.1)<br>Median: NR<br>Range: NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic clinic | 233 | Female: 145 (0.62)<br>Male: 88 (0.38) | Mean: 40.9 (SD 15.9)<br>Median: NR<br>Range: NR | NR |
| Noel, 2020[29] | Arm 1 | Standard care | 57 | Female: 35 (63)<br>Male: NR (NR) | Mean: 63.67 (SD 14.78)<br>Median: NR<br>Range: NR | Other (Non-Caucasian): 10 (18) |
| Noel, 2020[29] | Arm 2 | Treatment (teledoc) | 45 | Female: 29 (64)<br>Male: NR (NR) | Mean: 65.66 (SD 13.24)<br>Median: NR<br>Range: NR | Other (Non-Caucasian): 6 (1.3) |
| Olden, 2017[26] | Overall | Overall | 11 | Female: 2 (18.2)<br>Male: 9 (81.8) | Mean: 42.82 (SD 13.53)<br>Median: NR<br>Range: NR | White: 7 (63.6)<br>Black or African American: 1 (9.1)<br>Other (Hispanic): 2 (18.2) |
| Sherwood, 2019[36] | Overall | Telemedicine (TM) diagnosis | 376 | Female: 0 (0)<br>Male: 376 (100) | Mean: 42.3 (SD 13.2)<br>Median: NR<br>Range: NR | NR |
| Shirley, 2021[31] | Overall | Telemedicine | 25 | Female: 0 (0)<br>Male: 25 (100) | Mean: 81 (SD NR)<br>Median: Nr<br>Range: 58-96 | NR |
| Tham, 2021[30] | Overall | Overall | 341 | Female: 151 (44.3)<br>Male: 190 (55.7) | Mean: 62 (SD NR)<br>Median: NR (IQR 50-70)<br>Range: NR | Non-Hispanic-White: 263 (77.1)<br>Non-Hispanic-Black or African American: 59 (17.3)<br>Other (Asian, Alaskan native/American Indian, Hispanic White): 19 (5.6) |
| Tönnies, 2021[27] | Arm 1 | Control (standard care) | 27 | Female: 19 (70.4)<br>Male: 8 (29.6) | Mean: 51.2 (SD 15.46)<br>Median: 56 (IQR NR)<br>Range: 18-72 | NR |
| Tönnies, 2021[27] | Arm 2 | Intervention (Video-conference) | 23 | Female: 16 (69.6)<br>Male: 7 (30.4) | Mean: 45.9 (SD 15.86)<br>Median: 48 (IQR NR)<br>Range: 22-72 | NR |

CR = cardiac rehabilitation; IHT = Interactive Home Telehealth; IQR = interquartile range; N = sample size; NR = not reported; S-CR = standard cardiac rehabilitation; SD = standard deviation; TM = telemedicine

**Evidence Table C-4. Adverse event t or unintended effects outcomes (categorical) of studies addressing harms from patient-clinician real-time clinical encounters using telehealth**

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Afshari, 2022[15] | Overall | Telemedicine | Fall, or other adverse events | NR | NR | 15 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Blyler, 2021[16] | Overall | Video-conference | No treatment-related serious adverse events | NR | NR | 13 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Gonzalez, 2021[14] | Arm 1 | Usual care | Grade 3 adverse events | NR | 12 months | 68 | Patients with events: NR<br>N of events: 107 | NR | Ref | NR |
| Gonzalez, 2021[14] | Arm 2 | Intervention (mobile app/televisit) | Grade 3 adverse events | NR | 12 months | 68 | Patients with events: NR<br>N of events: 75 | NR | Comparator: Arm 1<br>p-value only: p=0.18 | NR |
| Gonzalez, 2021[14] | Arm 1 | Usual care | Grade 3 or higher adverse events | NR | 12 months | 68 | Patients with events: NR<br>N of events: 134 | NR | Ref | Age, sex, race, history of diabetes, years on dialysis, calculated panel reactive antibody, cold ischemic time, induction therapy, delayed graft function, cytomegalovirus (CMV) serostatus, and donor characteristics |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Gonzalez, 2021[14] | Arm 2 | Intervention (mobile app/televisit) | Grade 3 or higher adverse events | NR | 12 months | 68 | Patients with events: NR<br>N of events: 80 | NR | Comparator: Arm 1<br>Incidence rate ratio: 0.55 (95% CI: 0.30 to 0.99), p=0.05 | Age, sex, race, history of diabetes, years on dialysis, calculated panel reactive antibody, cold ischemic time, induction therapy, delayed graft function, cytomegalovirus (CMV) serostatus, and donor characteristics |
| Gonzalez, 2021[14] | Arm 1 | Usual care | Infections | NR | 12 months | 68 | Patients with events: NR<br>N of events: 86 | Rate per patient-year: 1.26 (95% CI: 0.76 to 1.76) | Ref | NR |
| Gonzalez, 2021[14] | Arm 2 | Intervention (mobile app/televisit) | Infections | NR | 12 months | 68 | Patients with events: NR<br>N of events: 90 | Rate per patient-year: 1.32 (95% CI: 0.92 to 1.72) | Comparator: Arm 1<br>p-value only: p=0.75 | NR |
| Gonzalez, 2021[14] | Arm 1 | Usual care | Opportunistic infections | NR | 12 months | 68 | Patients with events: NR<br>N of events: 10 | Rate per patient-year: 0.14 (95% CI: 0.01 to 0.30) | Ref | NR |
| Gonzalez, 2021[14] | Arm 2 | Intervention (mobile app/televisit) | Opportunistic infections | NR | 12 months | 68 | Patients with events: NR<br>N of events: 13 | NR | Comparator: Arm 1<br>p-value only: p=0.47 | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Gonzalez, 2021[14] | Arm 1 | Usual care | Total adverse events | NR | 12 months | 68 | Patients with events: NR<br>N of events: 1446 | NR | Ref | NR |
| Gonzalez, 2021[14] | Arm 2 | Intervention (mobile app/televisit) | Total adverse events | NR | 12 months | 68 | Patients with events: NR<br>N of events: 1406 | NR | Comparator: Arm 1<br>p-value only: p=0.85 | NR |
| Gonzalez, 2021[14] | Arm 1 | Usual care | Total medication errors | NR | 12 months | 68 | Patients with events: NR<br>N of events: 1385 | NR | Ref | NR |
| Gonzalez, 2021[14] | Arm 2 | Intervention (mobile app/televisit) | Total medication errors | NR | 12 months | 68 | Patients with events: NR<br>N of events: 614 | NR | Comparator: Arm 1<br>p-value only: p<0.001 | NR |
| Grossman, 2017[17] | Arm 1 | In-Person | Any major adverse event (not including death or surgery) | NR | NR | 10405 | Patients with events: 13 (0.12)<br>N of events: NR | NR | Ref | NR |
| Grossman, 2017[17] | Arm 2 | Telemedicine | Any major adverse event (not including death or surgery) | NR | NR | 8765 | Patients with events: 8 (0.09)<br>N of events: NR | NR | Comparator: Arm 1<br>p-value only: p=0.483 | NR |
| Grossman, 2017[17] | Arm 1 | In-Person | Any major adverse event or ED visit with treatment | NR | NR | 10405 | Patients with events: 33 (0.32)<br>N of events: NR | NR | Ref | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Grossman, 2017[17] | Arm 2 | Telemedicine | Any major adverse event or ED visit with treatment | NR | NR | 8765 | Patients with events: 16 (0.18)<br>N of events: NR | NR | Comparator: Arm 1<br>Difference in prevalence (%): 0.0013 (95% CI: -0.01 to 0.28), p=0.066 | NR |
| Grossman, 2017[17] | Arm 1 | In-Person | Hospital admission | NR | NR | 10405 | Patients with events: 13 (0.12)<br>N of events: NR | NR | Ref | NR |
| Grossman, 2017[17] | Arm 2 | Telemedicine | Hospital admission | NR | NR | 8765 | Patients with events: 6 (0.07)<br>N of events: NR | NR | Comparator: Arm 1<br>p-value only: p=0.216 | NR |
| Grossman, 2017[17] | Arm 1 | In-Person | Transfusion | NR | NR | 10405 | Patients with events: 7 (0.07)<br>N of events: NR | NR | Ref | NR |
| Grossman, 2017[17] | Arm 2 | Telemedicine | Transfusion | NR | NR | 8765 | Patients with events: 6 (0.07)<br>N of events: NR | NR | Comparator: Arm 1<br>p-value only: p=0.975 | NR |
| Hidecker, 2022[18] | Overall | Telemedicine | Hoarse voice, sore throat, strained neck, or unusual coughing | NR | NR | 13 | Patients with events: 9 (6; 1;1;1) (69.23)<br>N of events: NR | NR | NR | NR |
| Hidecker, 2022[18] | Overall | Telemedicine | Medication-related adverse event | NR | NR | 13 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Hidecker, 2022[18] | Overall | Telemedicine | Strain/sprain and muscle soreness | NR | NR | 13 | Patients with events: 2 (15.38)<br>N of events: NR | NR | NR | NR |
| Jackson, 2012[19] | Arm 1 | in-person usual care | Adverse events (including sprained ankle) | NR | 3 months | 8 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Jackson, 2012[19] | Arm 2 | Telemedicine | Adverse events (including sprained ankle) | NR | 3 months | 7 | Patients with events: 1 (14.28)<br>N of events: NR | NR | NR | NR |
| John, 2020[20] | Arm 1 | In-person evaluation | Mortality | NR | NR | 233 | Patients with events: 90 (NR)<br>N of events: NR | NR | NR | NR |
| John, 2020[20] | Arm 2 | telemedicine evaluation | Mortality | NR | NR | 232 | Patients with events: 67 (NR)<br>N of events: NR | NR | NR | NR |
| Keteyian, 2021[21] | Arm 1 | Standard cardiac rehabilitation (S-CR) | Adverse events or falls requiring hospitalization | NR | 3 hours | 21 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Keteyian, 2021[21] | Arm 2 | Hybrid cardiac rehabilitation (Hybrid-CR) | Adverse events or falls requiring hospitalization | NR | 3 hours | 26 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Levine, 2022[22] | Arm 1 | In-Person | Delirium | CMS patient safety measures | 30 days | 88 | Patients with events: 4 (4.8)<br>N of events: NR | NR | NR | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Levine, 2022[22] | Arm 3 | Telemedicine | Delirium | CMS patient safety measures | 30 days | 84 | Patients with events: 1 (1.1)<br>N of events: NR | NR | NR | NR |
| Levine, 2022[22] | Arm 1 | In-Person | Fall | CMS patient safety measures | 30 days | 88 | Patients with events: 1 (1.2)<br>N of events: NR | NR | NR | NR |
| Levine, 2022[22] | Arm 2 | Telemedicine | Fall | CMS patient safety measures | 30 days | 84 | Patients with events: 2 (2.3)<br>N of events: NR | NR | NR | NR |
| Luxton, 2015[23] | Overall | Telemental Health | Patient safety | NR | NR | 8 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Luxton, 2016[24] | Arm 1 | In-Person | Adverse events | NR | NR | 59 | Patients with events: 4 (6.78)<br>N of events: NR | NR | NR | NR |
| Luxton, 2016[24] | Arm 2 | In-Home | Adverse events | NR | NR | 62 | Patients with events: 7 (11.29)<br>N of events: NR | NR | NR | NR |
| Luxton, 2016[24] | Arm 1 | In-Person | Distress/suicidal ideation | NR | NR | 59 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Luxton, 2016[24] | Arm 2 | In-Home | Distress/suicidal ideation | NR | NR | 62 | Patients with events: 1 (1.61)<br>N of events: NR | NR | NR | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication: surgical site: deep | NR | 30 days | 485 | Patients with events: 1 (0.21)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication: surgical site: deep | NR | 30 days | 233 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication pneumonia | NR | 30 days | 485 | Patients with events: 1 (0.21)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication pneumonia | NR | 30 days | 233 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication: bowel obstruction | NR | 30 days | 485 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication: bowel obstruction | NR | 30 days | 233 | Patients with events: 1 (0.43)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication: bowel perforation | NR | 30 days | 485 | Patients with events: 1 (0.21)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication: bowel perforation | NR | 30 days | 233 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication: choledocholithiasis | NR | 30 days | 485 | Patients with events: 1 (0.21)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication: choledocholithiasis | NR | 30 days | 233 | Patients with events: 1 (0.43)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication: constipation | NR | 30 days | 485 | Patients with events: 4 (0.82)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication: constipation | NR | 30 days | 233 | Patients with events: 1 (0.43)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication: cystic duct leak | NR | 30 days | 485 | Patients with events: 1 (0.21)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication: cystic duct leak | NR | 30 days | 233 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication: Gastrointestinal Bleeding | NR | 30 days | 485 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication: Gastrointestinal Bleeding | NR | 30 days | 233 | Patients with events: 1 (0.43)<br>N of events: NR | NR | NR | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication: ileus | NR | 30 days | 485 | Patients with events: 4 (0.82)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication: ileus | NR | 30 days | 233 | Patients with events: 2 (0.86)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication: intra-abdominal abscess/hematoma | NR | 30 days | 485 | Patients with events: 3 (0.62)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication: intra-abdominal abscess/hematoma | NR | 30 days | 233 | Patients with events: 1 (0.43)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication: surgical site: superficial | NR | 30 days | 485 | Patients with events: 3 (0.62)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication: surgical site: superficial | NR | 30 days | 233 | Patients with events: 1 (0.43)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication: total | NR | 30 days | 485 | Patients with events: 21 (4.33)<br>N of events: NR | NR | NR | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication: total | NR | 30 days | 233 | Patients with events: 10 (4.29)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Complication: urinary tract infection | NR | 30 days | 485 | Patients with events: 1 (0.21)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Complication: urinary tract infection | NR | 30 days | 233 | Patients with events: 2 (0.86)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Death within 30 days | NR | 30 days | 485 | Patients with events: 1 (0.2)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Death within 30 days | NR | 30 days | 233 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Reoperation | NR | 30 days | 485 | Patients with events: 4 (0.8)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic Clinic | Reoperation | NR | 30 days | 233 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Olden, 2017[26] | Overall | Overall | Safety issues | NR | NR | 7 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Tönnies, 2021[27] | Arm 1 | Control (standard care) | Unintended consequences and adverse effects | NR | 16 weeks | 27 | Patients with events: NR<br>N of events: NR | NR | NR | NR |
| Tönnies, 2021[27] | Arm 2 | Intervention (Video-conference) | Unintended consequences and adverse effects | NR | 16 weeks | 22 | Patients with events: 4 (18.18)<br>N of events: NR | NR | NR | NR |

CI = confidence interval; CMS = Centers for Medicare & Medicaid Services; CMV = cytomegalovirus; ED = emergency department; N = sample size; NR = not reported; p = p-value; Ref = reference

**Evidence Table C-5. Adverse event or unintended effects outcomes (continuous) of studies addressing harms from patient-clinician real-time clinical encounters using telehealth**

| Author, Year | Arm | Arm Name | Outcome Defi-nition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Results | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Gonzalez, 2021[14] | Arm 1 | Usual care | Grade 3 adverse events rate | NR | 12 months | Baseline: 68<br>Followup: 68 | Baseline: NR<br>Followup: Mean 1.57 (SD 0.34) | NR | Ref | NR |
| Gonzalez, 2021[14] | Arm 2 | Intervention (mobile app/televisit) | Grade 3 adverse events rate | NR | 12 months | Baseline: 68<br>Followup: 68 | Baseline: NR<br>Followup: Mean 1.1 (SD 0.22) | NR | Comparator: Arm 1<br>p-value only: p=0.19 | NR |
| Gonzalez, 2021[14] | Arm 1 | Usual care | Grade 3 or higher adverse events rate | NR | 12 months | Baseline: 68<br>Followup: 68 | Baseline: NR<br>Followup: Mean 1.97 (SD 0.46) | NR | Ref | NR |
| Gonzalez, 2021[14] | Arm 2 | Intervention (mobile app/televisit) | Grade 3 or higher adverse events rate | NR | 12 months | Baseline: 68<br>Followup: 68 | Baseline: NR<br>Followup: Mean 1.18 (SD 0.25) | NR | Comparator: Arm 1<br>p-value only: p=0.04 | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Results | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Gonzalez, 2021[14] | Arm 1 | Usual care | Overall adverse events rate | NR | 12 months | Baseline: 68<br>Followup: 68 | Baseline: NR<br>Followup: Mean 21.26 (SD 25.24) | NR | Ref | NR |
| Gonzalez, 2021[14] | Arm 2 | Intervention (mobile app/televisit) | Overall adverse events rate | NR | 12 months | Baseline: 68<br>Followup: 68 | Baseline: NR<br>Followup: Mean 20.68 (SD 18.35) | NR | Comparator: Arm 1<br>p-value only: p=0.83 | NR |
| Gonzalez, 2021[14] | Arm 1 | Usual care | Overall medication error rate | NR | 12 months | Baseline: 68<br>Followup: 68 | Baseline: NR<br>Followup: Mean 20.4 (SD 14) | NR | Ref | Age, sex, race, history of diabetes, years on dialysis, calculated panel reactive antibody, cold ischemic time, induction therapy, delayed graft function, cytomegalovirus (CMV) serostatus, and donor characteristics |

| Author, Year | Arm | Arm Name | Outcome Defi-nition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Results | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Gonzalez, 2021[14] | Arm 2 | Intervention (mobile app/televisit) | Overall medi-cation error rate | NR | 12 months | Baseline: 68 Followup: 68 | Baseline: NR Followup: Mean 9 (SD 5.9) | NR | Comparator: Arm 1 Incidence rate ratio: 0.39 (95% CI: 0.28 to 0.55), p<0.001 | Age, sex, race, history of diabetes, years on dialysis, calculated panel reactive antibody, cold ischemic time, induction therapy, delayed graft function, cytomegalovi-rus (CMV) serostatus, and donor characteristics |
| Levine, 2022[22] | Arm 1 | Telemedicine | Fall | CMS patient safety measures | 30 days | Baseline: 84 Followup: 84 | Baseline: NR Followup: Mean 6.8 (95% CI 2.9-15.7) | NR | Comparator: Ref Difference represents the remote care group minus the control group.: 2.8, p=NR | Age, sex, race or ethnicity, HOSPITAL score |
| Levine, 2022[22] | Arm 1 | In-person | Transfer back to hospital | CMS patient safety measures | 30 days | Baseline: 88 Followup: 88 | Baseline: NR Followup: Mean 3.9 (95% CI 1.4 - 11.0) | NR | Comparator: Ref Difference represents the remote care group minus the control group.: 2.8, p=NR | Age, sex, race or ethnicity, HOSPITAL score |

CI = confidence interval; CMS = Centers for Medicare & Medicaid Services; CMV = cytomegalovirus; HOSPITAL = hemoglobin at discharge, discharge from an oncology service, sodium level at discharge, procedure during the index admission, index type of admission, number of admissions during last 12 months, and length of stay; N = sample size; NR = not reported; p = p-value; Ref = reference; SD = standard deviation

**Evidence Table C-6. Preventable hospitalizations or emergency department visits outcomes (categorical) of studies addressing harms from patient-clinician real-time clinical encounters using telehealth**

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Bednarski, 2019[28] | Arm 1 | Control | ED visit | NR | 30 days | 16 | Patients with events: 1 (6.25) N of events: NR | NR | NR | NR |
| Bednarski, 2019[28] | Arm 2 | RecoverMI | ED visit | NR | 30 days | 14 | Patients with events: 2 (14.29) N of events: NR | NR | NR | NR |
| Bednarski, 2019[28] | Arm 1 | Control | Readmission | NR | 30 days | 16 | Patients with events: 0 (0) N of events: NR | NR | NR | NR |
| Bednarski, 2019[28] | Arm 2 | RecoverMI | Readmission | NR | 30 days | 14 | Patients with events: 2 (14.29) N of events: NR | NR | NR | NR |
| Chu, 2015[35] | Over-all | Overall | Emergency department visit | NR | 30 days | 97 | Patients with events: 1 (1.03) N of events: NR | NR | NR | NR |
| Delman, 2021[34] | Arm 1 | Pre-COVID-19 | Readmission | NR | 30 days | 274 | Patients with events: 26 (41.9) N of events: NR | NR | Ref | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Delman, 2021[34] | Arm 2 | COVID-19 | Readmission | NR | 30 days | 70 | Patients with events: 20 (61.5)<br>N of events: NR | NR | Comparator: Arm 1<br>p-value only: p=0.09 | NR |
| Gonzalez, 2021[14] | Arm 1 | Usual care | Total hospitali-zations | NR | 12 months | 68 | Patients with events: NR<br>N of events: 74 | Rate per patient-year: 1.08 (95% CI: 0.6 to 1.6) | Ref | Age, sex, race, history of diabetes, years on dialysis, calculated panel reactive antibody, cold ischemic time, induction therapy, delayed graft function, cytomegalovi-rus (CMV) serostatus, and donor characteristics |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Gonzalez, 2021[14] | Arm 2 | Intervention (mobile app/televisit) | Total hospitali-zations | NR | 12 months | 68 | Patients with events: NR<br>N of events: 44 | Rate per patient-year: 0.65 (95% CI: 0.4 to 0.94) | Comparator: Arm 1<br>Incidence rate ratio: 0.46 (95% CI: 0.27 to 0.77), p=0.005 | Age, sex, race, history of diabetes, years on dialysis, calculated panel reactive antibody, cold ischemic time, induction therapy, delayed graft function, cytomegalovi-rus (CMV) serostatus, and donor characteristics |
| Grossman, 2017[17] | Arm 1 | In-Person | ED visit with treatment | NR | NR | 10405 | Patients with events: 22 (0.21)<br>N of events: NR | NR | Ref | NR |
| Grossman, 2017[17] | Arm 2 | Telemedicine | ED visit with treatment | NR | NR | 8765 | Patients with events: 13 (0.15)<br>N of events: NR | NR | Comparator: Arm 1<br>p-value only: p=0.308 | NR |
| Harkey, 2021[32] | Arm 1 | In-Person | All-cause Hospitalization encounter | NR | 30 days | 101 | Patients with events: 16 (15.8)<br>N of events: NR | NR | Ref | NR |
| Harkey, 2021[32] | Arm 2 | Virtual visit | All-cause Hospitalization encounter | NR | 30 days | 135 | Patients with events: 15 (11.1)<br>N of events: NR | NR | Comparator: Arm 1<br>2-sided effect: -4.7, p=0.29 | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Hickey, 2017[33] | Over-all | Interactive Home Telehealth | Unintended readmission | NR | 30 days | 31 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Levine, 2022[22] | Arm 1 | In-Person | Transfer back to hospital | CMS patient safety measures | 30 days | 88 | Patients with events: 3 (3.6)<br>N of events: NR | NR | NR | NR |
| Levine, 2022[22] | Arm 4 | Telemedicine | Transfer back to hospital | CMS patient safety measures | 30 days | 84 | Patients with events: 2 (2.3)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | ED visits within 30 days | NR | 30 days | 485 | Patients with events: 19 (3.9)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic clinic | ED visits within 30 days | NR | 30 days | 233 | Patients with events: 11 (4.2)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 1 | Traditional clinic | Readmission within 30 days | NR | 30 days | 485 | Patients with events: 14 (2.8)<br>N of events: NR | NR | NR | NR |
| Nikolian, 2018[25] | Arm 2 | Electronic clinic | Readmission within 30 days | NR | 30 days | 233 | Patients with events: 6 (2.7)<br>N of events: NR | NR | NR | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Noel, 2020[29] | Arm 1 | Standard care | ED visit | NR | 30 days | 57 | Patients with events: NR<br>N of events: NR | NR | Ref | Age, gender, number of diagnoses |
| Noel, 2020[29] | Arm 2 | Treatment (teledoc) | ED visit | NR | 30 days | 45 | Patients with events: NR<br>N of events: NR | NR | Comparator: Arm 1<br>OR: 0.75 (95% CI: 0.18 to 3.11), p=0.691 | Age, gender, number of diagnoses |
| Noel, 2020[29] | Arm 1 | Standard care | Readmission | NR | 30 days | 57 | Patients with events: NR<br>N of events: NR | NR | Ref | Age, gender, number of diagnoses |
| Noel, 2020[29] | Arm 2 | Treatment (teledoc) | Readmission | NR | 30 days | 45 | Patients with events: NR<br>N of events: NR | NR | Comparator: Arm 1<br>OR: 2.65 (95% CI: 0.4 to 17.33), p=0.311 | Age, gender, number of diagnoses |
| Sherwood, 2018[36] | Over-all | Telemedicine (TM) diagnosis | ED visit | NR | NR | 376 | Patients with events: 0 (0)<br>N of events: NR | NR | NR | NR |
| Tham, 2021[30] | Arm 1 | Without postop telehealth | Emergency department visit (30 days post-discharge) | NR | 30 days | 46 | Patients with events: 8 (17.4)<br>N of events: NR | NR | Ref | NR |

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Tham, 2021[30] | Arm 2 | With postop telehealth | Emergency department visit (30 days post-discharge) | NR | 30 days | 295 | Patients with events: 7 (2.4)<br>N of events: NR | NR | Comparator: Arm 1<br>p-value only: p<0.0001 | NR |
| Tham, 2021[30] | Arm 1 | Without postop telehealth | Readmission (30 days post-discharge) | NR | 30 days | 46 | Patients with events: 7 (15.2)<br>N of events: NR | NR | Ref | NR |
| Tham, 2021[30] | Arm 2 | With postop telehealth | Readmission (30 days post-discharge) | NR | 30 days | 295 | Patients with events: 10 (3.4)<br>N of events: NR | NR | Comparator: Arm 1<br>p-value only: p=0.0006 | NR |

CI = confidence interval; CMS = Centers for Medicare & Medicaid Services; CMV = cytomegalovirus; ED = emergency department; N = sample size; NR = not reported; OR = odds ratio; p = p-value; Ref = reference

**Evidence Table C-7. Preventable hospitalizations or emergency department visits outcomes (continuous) of studies addressing harms from patient-clinician real-time clinical encounters using telehealth**

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Results | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Levine, 2022[22] | Arm 1 | In-person | Transfer back to hospital | CMS patient safety measures | 30 days | Baseline: 88<br>Followup: 88 | Baseline: NR<br>Followup: Mean 3.43 (95% CI 1.11-10.07) | NR | Comparator: Arm 1<br>Difference represents the remote care group minus the control group.: 2.28, p=NR | Age, sex, race or ethnicity, hospital score |
| Levine, 2022[22] | Arm 2 | Telemedicine | Transfer back to hospital | CMS patient safety measures | 30 days | Baseline: 84<br>Followup: 84 | Baseline: NR<br>Followup: Mean 5.7 (95% CI 2.28-15.56) | NR | Comparator: Arm 1<br>Difference represents the remote care group minus the control group.: 2.28, p=NR | Age, sex, race or ethnicity, hospital score |
| Shirley, 2021[31] | Overall | Telemedicine | VA ED visit | NR | 6 months | Baseline: 25 | Baseline: NR<br>Followup: | NR | NR | NR |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Followup: 12 | Mean 0.16 (Range 0-3) | | | |
| Shirley, 2021[31] | Overall | Telemedicine | VA hospital admission | NR | 6 months | Baseline: 25 Followup: 12 | Baseline: NR Followup: Mean 0.36 (Range 0-3) | NR | NR | NR |

CI = confidence interval; CMS = Centers for Medicare & Medicaid Services; ED = emergency department; N = sample size; NR = not reported; p = p-value; Ref = reference; VA = United States Department of Veterans Affairs

**Evidence Table C-8. Misdiagnosis or delayed diagnosis outcomes (categorical) of studies addressing harms from patient-clinician real-time clinical encounters using telehealth**

| Author, Year | Arm | Arm Name | Outcome Definition | Patient Safety Measures | Time Point at Analysis | N at Analysis | Outcome | Within-Arm Comparison | Between-Arm Comparison | Adjusted Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| Sherwood, 2019[36] | Overall | Subsequent in person follow-up | Non-concordance | NR | NR | 210 | Patients with events: 22 N of events: NR | NR | NR | NR |

N = sample size; NR = not reported

# Appendix D. Grey Literature Search Results

**Table D-1. Grey literature search results from governmental agencies and professional societies**

| Source (Link) | Document's Title (type) | Relevant Outcomes | Telehealth Intervention | Results | Summary |
|---|---|---|---|---|---|
| American Medical Association (AMA) (https://www.ama-assn.org/)<br><br>retrieved: 1/6/2023 | AMA Digital Health Research [2016 – 2020] (report)[37] | PSP | Televisits & Telemedicine tools – monitoring/care management and clinical decisions support. | Most physicians find that adopting these methods improve patient safety and work efficiency. | This report is focused on survey results of physician's motivation and requirements for adopting telemedicine into their practices. Physicians were surveyed to determine how many adopted these methods and how they've effected patient care |
| | AMA Return on Health Report [2021] (case reports)[38] | Emergency department (ED) visits, readmissions rates, mortality | Televisits & Telemedicine | Many of the case studies report findings that telemedicine works to improve patient safety compared to traditional care alone. Including, lowering mortality, ED visits and reducing readmission rates. | Authors proposed a "framework for measuring the value of digitally enabled care". Several organizations report research efforts guided by this framework to measure the impact of their telemedicine implementation. |

| Source (Link) | Document's Title (type) | Relevant Outcomes | Telehealth Intervention | Results | Summary |
|---|---|---|---|---|---|
| Patient Safety Learning hub (https://www.pslhub.org/)<br><br>retrieved: 1/9/2023 | Telemedicine: Ensuring Safe, Equitable, Person-Centered Virtual Care (white paper)[39] | PSP | Televisits & Telemedicine | Authors recommend inviting/engaging patients and patient advocates (e.g., family/friends), provide training for tele-visits and limited physical exams, and to incorporate ancillary support in virtual care practices; Recommendations included improved communication skills (also an element in framework, discussed further in report), and to be cognizant of patient's emotional/psychological state by inviting patient to share their concerns related to telemedicine versus in-person care. | The Lucian Leape Institute developed and published a telemedicine implementation guide. Using their framework, authors define its elements in the clinical context and provide recommendations for the how to improve telehealth implementation in respect to patient safety |

| Source (Link) | Document's Title (type) | Relevant Outcomes | Telehealth Intervention | Results | Summary |
|---|---|---|---|---|---|
| World Health Organization's Global Patient Safety Network (https://www.who.int/teams/integrated-health-services/patient-safety)<br><br>retrieved: 1/9/2023 | Consolidated telemedicine implementation guide (implementation guide)[40] | PSP | Televisits & Telemedicine | This guide solely focused on privacy and data protection for patients. And insist on training and accreditation for health works to maintain the safety for patients. | The World Health Organization developed an implementation guide for the use of telemedicine. The guide is organized into phases and steps within each phase. The most relevant to this is the phase 02 (plan the implementation) and step 06 (enforce mechanism for patient and health worker safety and protection) |

| Source (Link) | Document's Title (type) | Relevant Outcomes | Telehealth Intervention | Results | Summary |
|---|---|---|---|---|---|
| Agency of Healthcare Research and Quality (https://www.ahrq.gov/)<br><br>retrieved: 1/11/2023 | Telehealth and Patient Safety (primer)[41] | PSP | Telehealth & telehealth care models | Authors propose potential implementation strategies to enhances patient safety. Strategies include clinician education on patient safety considerations and evidence-based strategies for conducting telehealth encounters, coordinate care with medical home staff, integrating protocols and safety reports to prevent adverse events, utilize remote and accessible technologies for patients and caregiver | Reports emerging concerns related to the use of telemedicine (and its modalities) on patient safety. The concerns outlined are diagnostic errors, medication safety, escalation of care and health equity. Attributing adverse events to poor communication, limited physical examination, and reliance on patient to report vitals or symptoms. The rapid adoption of telemedicine into medical practices has led to disparities in access in care access, especially among the elderly, ethnic minorities and 'less-resources' individuals. |

| Source (Link) | Document's Title (type) | Relevant Outcomes | Telehealth Intervention | Results | Summary |
|---|---|---|---|---|---|
| | Telemedicine and Patient Safety (perspectives)[42] | Adverse events, treatment-related errors, & PSP | Telemedicine | Authors report that telemedicine has worked to help identify and prevent both treatment-related errors and treatment-related adverse events | Authors of this article propose that the adoption of telemedicine in health care has the potential to improve patient health outcomes and overall clinical operations. They acknowledge the emerging concerns for patient safety and emphasizes that patient safety should 'permeate' through all phases of telemedicine implementation and uses |

| Source (Link) | Document's Title (type) | Relevant Outcomes | Telehealth Intervention | Results | Summary |
|---|---|---|---|---|---|
| | Telehealth and Patient Safety During the COVID-19 Response (perspectives)[43] | Diagnostic errors & PSP | Telemedicine | Authors propose precaution measures to take for implementing and using telehealth. For namely, escalation protocols which determine when a patient should transition to urgent care for follow-up or receive emergency care. Also, pre-charting, which will allow providers to conduct a detailed review of patients to determine whether telehealth is appropriate for their care. Conduct quality assurances for telehealth visits to discuss positive and negative patient safety concerns. Lastly, authors encourage that providers receive telehealth training for effective communication and best practices for tele-visits. | Presents an overview of the role of the COVID-19 pandemic's role in the rapid adopting of telehealth in healthcare delivery. Reporting its positive effect on patient and provider safety from the spread of the COVID-19 virus. Authors acknowledge emerging patient safety concerns related to the use of telemedicine. Namely, the limitations of remote care, potential diagnostic errors, and effective communication. |

AMA = American Medical Association; ED = emergency department; PSP = patient safety practice