



Summary of Findings

NSF International, an independent public health organization, sought to examine the difference between perception and reality when it came to where germs lurk in the home. Through a swab analysis of 30 common items in the households of 22 volunteer families, NSF International found some surprising results.

The biggest misconception identified through the study was that the bathroom is the dirtiest place in the house when in fact the kitchen had the most germs. NSF swabbed for Coliform bacteria - a family of bacteria that includes *Salmonella* and *E. coli* and is an indicator of potential fecal contamination – and found that Coliform was found on:

- More than 75% of dish sponges/rags
- 45% of kitchen sinks
- 32% of counter tops
- 18% of cutting boards

This compares to the bathroom where areas with the most Coliform only included:

- 27% of toothbrush holders
- 9% of bathroom faucet handles

According to the studies' findings, the areas in which food is prepared actually contained more bacteria and fecal contamination than many other places in the home.

Other findings include:

Breeding Environment for Germs: Warm and moist environments are breeding grounds for germs. NSF's analysis shows sponges and coffee reservoirs, which may not be cleaned as frequently as they should be, were in the top 10 germiest places in the home.

Materials that Hold Germs: Smooth, cold surfaces tend to harbor less germs. NSF's analysis shows that keys, money, computer keyboards, and game controllers did not have a lot of germs.

About NSF International: NSF International is an independent, not-for-profit organization, helps protect consumers by certifying products and writing standards for food, water, dietary supplements and consumer goods to minimize adverse health effects and protect the environment (www.nsf.org).

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Detailed Swab Analysis

A testing swab is essentially a large Q-tip saturated with a sterile liquid that helps pick-up the germs. Each volunteer was provided a swabbing kit that included a swab for each of the 30 household items to be analyzed. Volunteers were instructed to rub the wet swab tip in a turning motion across a 3x3 inch (10x10 cm) area of each of the 30 items and place back into the swab container – without touching the tip to anything else – to be analyzed by NSF Microbiologists.

Coliform present in 81% of households:

Over 30 surfaces were tested in 22 households for Coliform bacteria. Coliforms (a family of bacteria that includes *Salmonella* and *E. coli*) are an indicator of potential fecal contamination. In the study, Coliforms were primarily found on surfaces in the kitchen and the bathroom and also on many personal items. Coliforms were present in over 81% of the households and on 26 of the 30 items tested.

We observed that Coliforms were most prevalent on items in the kitchen. Over 75% of the families had Coliform on the dish sponge/rag, 45% in the kitchen sink, 32% on the counter top and 18% on the cutting board. The top items and percentage of households that had coli form are detailed below.

Sources of Coliforms are unwashed produce, raw meat and poultry, not washing hands after using the bathroom and pets. *E. coli* is a member of the Coliform family and was found in the pet bowl from two families. It was found on less than 1% of all surfaces sampled in the survey.

Yeast and mold present in 31% of households

Yeast and mold were found 31% of the households. Yeast and mold are considered to have a negative impact on health since they may elicit an allergenic response in a certain percentage of the population. The kitchen again led the way for households in the survey:

- 86% of families had yeast and mold on the dish sponge/rag
- 50% in the coffee reservoir of the coffee maker
- 68% of families had yeast and mold on the computer key board
- 64% on the toothbrush holder
- 59% on the video game controller
- 55% on the remote control
- 55% on the pet toy



Yeast and mold was found on moist, wet items such as the dish sponge and coffee reservoir, and on many of the items that people typically use while eating. People tend to eat at their computers over the key board, while they watch TV and play video games.

***Staphylococcus aureus* (Staph) present in over 5% over households**

Staph was present in over 5% of households surveyed. Staph is a MRSA indicator as defined by the Mayo clinic:

Methicillin-resistant *Staphylococcus aureus* (MRSA) infection is caused by a strain of staph bacteria that's become resistant to the antibiotics commonly used to treat ordinary staph infections.

Specifically related to staph findings:

- Pet toy had staph in 23% of these households
- Dish sponge/rag in 18% of households
- Refrigerator handle in 14% of households
- Toothbrush holder in 14% of households
- Pet bowl in 14% of households
- Remote control in 14% of households
- Video controller in 14% of households
- Pens in 14% households



About the Survey

As of January 17, 2011, 22 volunteer families had 30 locations sampled for germs within their homes and car. The survey included items in the kitchen, bathroom as well as other commonly used devices such as cell phones and items like purses for the presence of bacteria, yeast and mold. The size of the test area was about the size of a standard yellow sticky note from 3M, roughly 3 X 3 inches.

An Examination of Perception vs. Reality

Before testing these items, the volunteers were asked to rate the items they thought would be the dirtiest. Below is a comparison of what volunteers thought were the dirtiest items in the house vs. what the swab analysis actually found to be true. Following is a list of what were perceived to be the germiest items in the home versus the actual germiest items (ranked from highest to lowest in germ count):

Volunteers thought:

1. Toothbrush holder
2. Dish sponge/rag
3. Money
4. Pet Toy
5. Counter top
6. Bathroom door knob
7. Kitchen sink
8. Pet bowl
9. Toilet handle
10. Bathroom light switch

Actual:

1. Dish sponge/rag
2. Kitchen sink
3. Toothbrush holder
4. Pet bowl
5. Coffee reservoir
6. Bathroom faucet handle
7. Pet toy
8. Counter top
9. Stove knobs
10. Cutting board

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Detailed Coliform, yeast/mold and staph data from 22 homes

Coliform data: Coliform was found in 81% of homes. The list below identifies the item where Coliform was present and the percentage of the homes that contained Coliform on that item.

Kitchen:

1. Dish sponge/rag: 77%
2. Kitchen sink: 45%
3. Countertop: 32%
4. Cutting board: 18%
5. Stove knobs: 14%
6. Refrigerator handle: 9%
7. Coffee Reservoir: 9%
8. Lunch box: 9%
9. microwave handle: 5%

Pet items:

1. Pet bowl: 18%
2. Tennis ball/pet toy: 14%

Bathroom:

1. Toothbrush holder: 27%
2. Bathroom faucet handle: 9%
3. Toilet seat: 5%
4. Bathroom door knob: 5%
5. Bathroom light switch: 5%

Personal items

1. Money: 9%
2. Cell phone: 5%
3. remote control: 5%
4. Key board: 5%
5. iPod: 5%
6. Video game controller: 5%
7. wallet: 5%
8. keys: 5%
9. pens: 5%
10. gear shift: 5%

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Detailed Coliform, yeast/mold and staph data from 22 homes

Yeast and mold data: Found in 31.7% of homes. The list below identifies the item yeast and mold was present on and the percentage of the homes that contained Coliform on that item.

Kitchen

1. Dish sponge/rag: 86%
2. Coffee reservoir: 50%
3. Stove knobs: 27%
4. Kitchen sink: 27%
5. Refrigerator handle: 23%
6. Counter top: 18%
7. Cutting board: 14%
8. Microwave handle: 5%

Bathroom

1. toothbrush holder: 64%
2. Bathroom faucet handle: 27%
3. toilet seat: 27%
4. bathroom light switch: 23%
5. toilet handle: 14%
6. bathroom door knob: 14%

Pets

1. Pet toy: 55%
2. Pet bowl: 45%

Personal items

1. keyboard: 68%
2. video game controller: 59%
3. remote control: 55%
4. bottom of purse: 36%
5. iPod: 32%
6. Cell phone: 23%
7. pens: 23%
8. lunch box: 23%
9. wallet: 18%
10. keys: 9%
11. money: 9%

Car

1. door handle: 41%
2. steering wheel: 18%
3. gear shift: 18%



Detailed Coliform, yeast/mold and staph data from 22 homes

Staph data: found in 6.4% of homes.

Kitchen

1. Dish sponge/rag: 18%
2. Refrigerator handle: 14%
3. Counter top: 0%
4. Stove knobs: 5%
5. microwave handle: 5%
6. cutting board: 0%
7. Coffee reservoir: 0%
8. Kitchen sink: 0%

Bathroom

1. toothbrush holder: 14%
2. toilet handle: 9%
3. Bathroom faucet handle: 5%
4. toilet seat: 5%
5. bathroom door knob: 5%
6. bathroom light switch: 0%

Pets

1. Pet toy: 23%
2. Pet bowl: 14%

Personal items

1. remote control: 14%
2. pens: 14%
3. video game controller: 14%
4. keyboard: 9%
5. Cell phone: 5%
6. lunch box: 9%
7. keys: 9%
8. wallet: 5%
9. bottom of purse: 0%
10. iPod: 0%
11. money: 0%

Car

1. steering wheel: 0%
2. Door handle: 0%
3. gear shift: 0%



Percent of Surface Positive for Selective Organisms

KEY	E coli	Coliform	Staph Aureus	Yeast / Mold (>10 CFU per s	
1	Kitchen Sink	0%	45%	0%	27%
2	Countertop	0%	32%	0%	18%
3	Refrigerator Handle	0%	9%	14%	23%
4	Microwave Handle	0%	5%	5%	5%
5	Cutting Board	0%	18%	0%	14%
6	Dish Sponge/Rag	0%	77%	18%	86%
7	Stove Knobs	0%	14%	5%	27%
8	Coffee Reservoir	0%	9%	0%	50%
9	Bathroom Faucet Handle	0%	9%	5%	27%
10	Toilet Handle	0%	0%	9%	14%
11	Toilet Seat	0%	5%	5%	27%
12	Bathroom Door Knob	0%	5%	5%	14%
13	Bathroom Light Switch	0%	5%	0%	23%
14	Toothbrush Holder	0%	27%	14%	64%
15	Pet Bowl	9%	18%	14%	45%
16	Tennis Ball/ Pet Toy	0%	14%	24%	57%
17	Cellular Phone	0%	5%	5%	23%
18	Remote Control	0%	5%	14%	55%
19	Keyboard	0%	5%	9%	68%
20	iPod	0%	5%	0%	32%
21	Lunch Box	0%	9%	9%	23%
22	Video game controller	0%	5%	14%	59%
23	Bottom of Purse	0%	0%	0%	36%
24	Wallet	0%	5%	5%	18%
25	Keys	0%	5%	9%	9%
26	Pens	0%	5%	14%	23%
27	Car Steering Wheel	0%	0%	0%	18%
28	Car Door Handle	0%	0%	0%	41%
29	Gear Shift	0%	5%	0%	18%
30	Money	0%	9%	0%	9%



Swab Analysis Findings in Summary

Below is a list ranking the germ counts on each of the household items (ranked from having the most to least germs). The list below is an average normalized count of germs (including Staph, Coliform and yeast and mold) across the 22 households that were swabbed.

Location	Average Normalized Microorganisms	
Dish Sponge/Rag	362,631,038	Per g
Kitchen Sink	11,381,285	Per 10 sq. cm
Toothbrush Holder	2,465,876	Per 10 sq. cm
Pet Bowl	1,476,612	Per 10 sq. cm
Coffee Machine Reservoir	548,270	Per 10 sq. cm
Bathroom Faucet Handle	17,976	Per 10 sq. cm
Pet Toy Tennis Ball	14,121	Per 10 sq. cm
Countertop	4,590	Per 10 sq. cm
Stove Knobs	992	Per 10 sq. cm
Cutting Board	713	Per 10 sq. cm
Toilet Seat	515	Per 10 sq. cm
Pens	306	Per 10 sq. cm
Bathroom Doorknob	257	Per 10 sq. cm
Bathroom Light Switch	219	Per 10 sq. cm
Microwave Handle	202	Per 10 sq. cm
Keys	200	Per 10 sq. cm
Cellular Phone	178	Per 10 sq. cm
Gear Shift	123	Per 10 sq. cm
Toilet Handle	107	Per 10 sq. cm
Car Door Handle	97	Per 10 sq. cm
Refrigerator Handle	97	Per 10 sq. cm
iPod	86	Per 10 sq. cm
Lunch Box	75	Per 10 sq. cm
Video Game Controller	60	Per 10 sq. cm
Remote Control	57	Per 10 sq. cm
Bottom of Purse	45	Per 10 sq. cm
Wallet	37	Per 10 sq. cm
Keyboard	37	Per 10 sq. cm
Money	11	Per 10 sq. cm
Car Steering Wheel	4	Per 10 sq. cm



Methodology

The NSF International "Germiest Places in the Home 2011" study was conducted by microbiologists at NSF International from December 2010 - January 2011. As of January 17, 2011, 22 volunteer families from the Greater Ann Arbor region sampled 30 locations for germs within their homes and car. The survey included items in the kitchen, bathroom as well as other commonly used devices such as cell phones and items like purses for the presence of bacteria, yeast and mold. [See sampling instructions, pre-sampling questionnaire and location guide below].

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Methodology

Sampling Instructions:

The day of your sampling event you will be provided with a sampling kit. The kit will contain the following:

- Cooler
- Ice pack
- 30 swabs with neutralizer solution
 - Note: the liquid provided with the swab is non-toxic
- 1 sample container for a sponge sample
- Sharpie
- Gloves (nitrile)
- Sample form

The directions for using the swabs are as follows:

- Remove swab from container.
- Snap swab so that liquid fills the swab chamber.
- Remove swab from chamber.
 - NOTE: BE CAREFUL NOT TO TOUCH SWAB TIP TO ANYTHING BUT THE TARGET SURFACE.
 - NOTE: Be careful not to lose any of the fluid within the swab chamber.
- Sample surface using a turning motion.
 - For flat surfaces, sample area using horizontal pattern then a diagonal pattern.
 - If possible, sample a maximum area of 10 cm x 10 cm.
 - For other surfaces, sample as directed.
- Once sample is taken, place swab back into the container, being careful not to touch the tip of the swab to any other surface.
 - Note: Make sure cap is snug and fits properly so that there is no risk of leaking during storage.
- Using a sharpie, label the swab with the location number of the sample (use the guide provided).
- For sponge sample, cut a 10 cm x 10 cm square from the sponge and place in the sample bag (Whirlpack) provided.
- Place swabs and sponge bag into cooler.
 - Note: Please try to store and transport the swabs in an upright position.
- Immediately record the measured surface area on the sampling sheet.
 - Note: Record all measurements in CENTIMETERS.
- Place cooler in refrigerator overnight and bring to the Microbiology lab the following morning for processing.

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Methodology

Pre-Sampling Questionnaire

1. How many adults and children reside in your household?
2. What are the ages and gender of the children?
3. What is the average age range of the adults?
 - a. Circle one: 20-30 31-40 41-50 51-60 61-70 71-80
4. Do you have a scheduled cleaning regimen for your house?
5. If so, do you perform the cleaning yourself or do you utilize a commercial cleaning service?
6. Do you have pets?
7. What type of pets do you have (and how many of each)?
8. Do your pets reside indoors or outdoors?
9. How often do you use hand sanitizers?
 - a. Circle one: never once per month weekly daily
10. Do you wash your hands before every meal?
 - a. Circle one: yes no
11. Do you stress handwashing to your children?
 - a. Circle one: yes no

Pre-sampling Expectations for the Sample Locations – Part I

Of the 30 sample locations listed on the guide, please list the top 10 locations which you think will be the dirtiest (i.e. harbor the most microorganisms). List in order from most to least.

Pre-sampling Expectations for the Sample Locations – Part II

Of the 30 sample locations listed the guide, please list the top 10 locations which you think will harbor organism most likely to cause human illness. List in order from highest threat to least.

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Methodology

Sample Location Guide

Kitchen
1. Kitchen Sink
2. Countertop
3. Refrigerator Handle
4. Microwave Handle
5. Cutting Board
6. Dish Sponge/Rag
7. Stove Knobs
8. Coffee Reservoir
Bathroom
9. Faucet Handle
10. Toilet Handle
11. Toilet Seat
12. Bathroom Door Knob
13. Bathroom Light Switch
14. Toothbrush Holder
Pets
15. Pet Bowl
16. Tennis Ball/ Pet Toy
Electronics
17. Cellular Phone
18. Remote Control
19. Keyboard
20. iPod
Kids
21. Lunch Box
22. Video game controller
Personal Belongings
23. Bottom of Purse
24. Wallet
25. Keys
26. Pens
Other
27. Car Steering Wheel
28. Car Door Handle
29. Gear Shift
30. Money

Contact

For more information on NSF International's 2011 Household Germ Study, please contact Greta Houlahan, Senior Manager of Communications, at 734.913.5723 or email houlahan@nsf.org.