Multi-drug Resistant Organisms and the Role of the Environment in Transmission

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Objectives

Define

- Multi-drug resistant organisms (MDRO) and provide examples

Identify

- The role colonization plays in MDRO transmission

Emphasize

- The importance of cleaning and disinfecting the healthcare environment to prevent MDRO transmission

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What are Multi Drug Resistant Organisms (MDRO)?

- In general, MDROs are defined as microorganisms, predominantly bacteria, that are resistant to more than 1 class of antimicrobial agents
- MDROs are a public health problem because they can spread easily and can be difficult to treat

https://www.cdc.gov/vitalsigns/pdf/2018-04-vitalsigns.pdf

UNUSUAL ANTIBIOTIC-RESISTANT GERMS

- Resistant to all or most antibiotics tested, making them hard to treat, and
- Uncommon in a geographic area or the US, or
- Have special genes that allow them to spread their resistance to other germs

Examples of unusual resistance: Vancomycin-resistant *Staphylococcus aureus* (VRSA), *Candida auris*, and certain types of "nightmare bacteria" such as carbapenem-resistant Enterobacteriaceae (CRE).

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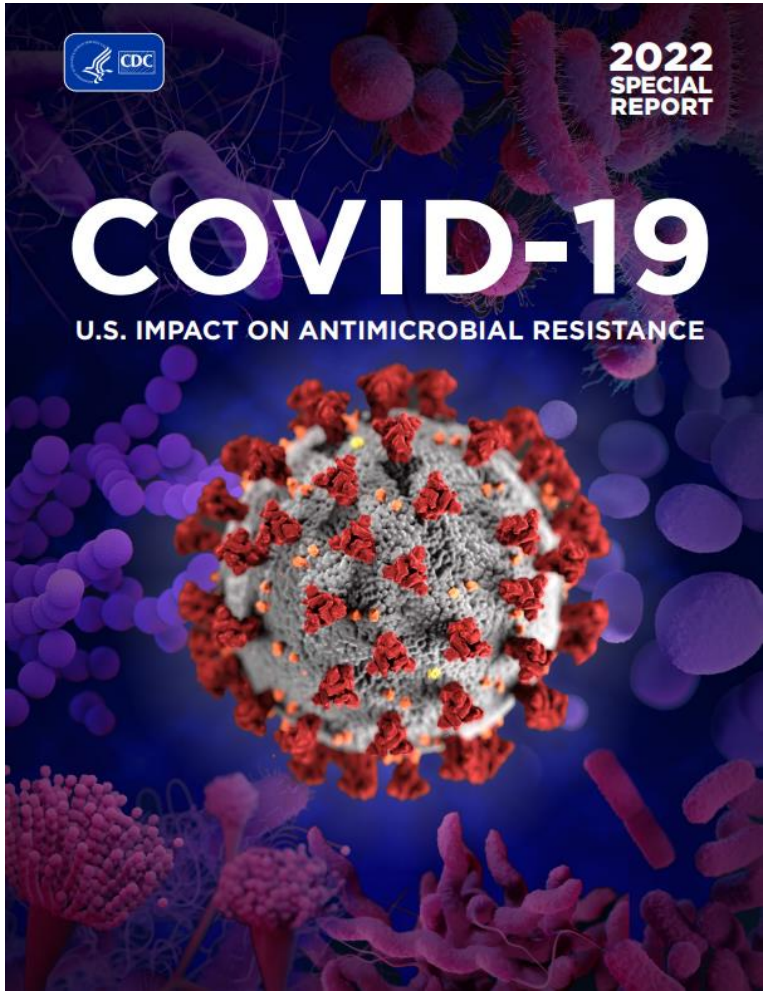
MDROs and the COVID-19 Pandemic



CDC's COVID-19 Impact Report indicates:

- A significant increase in antimicrobial use since 2020
- Difficulty in following infection prevention and control guidance

Resulting in a **15% increase** in healthcare-associated antimicrobial-resistant **infections and deaths** during the first year of the pandemic

https://www.cdc.gov/drugresistance/pdf/covid19-impact-report-508.pdf

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Colonization vs. Infection with MDROs

Colonization

Colonization is when organisms are on or in the body but do not make you sick

Infection

Infection is when organisms are in or on the body and make you sick

Sherry L, et al. 2017. *Emerging Infectious Diseases*

Wysocki AACN *Adv Crit Care* (2002)

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Audience Poll #1

Q. Do you know which MDROs are reportable in the city of Philadelphia?

A. Yes

B. No

C. Maybe

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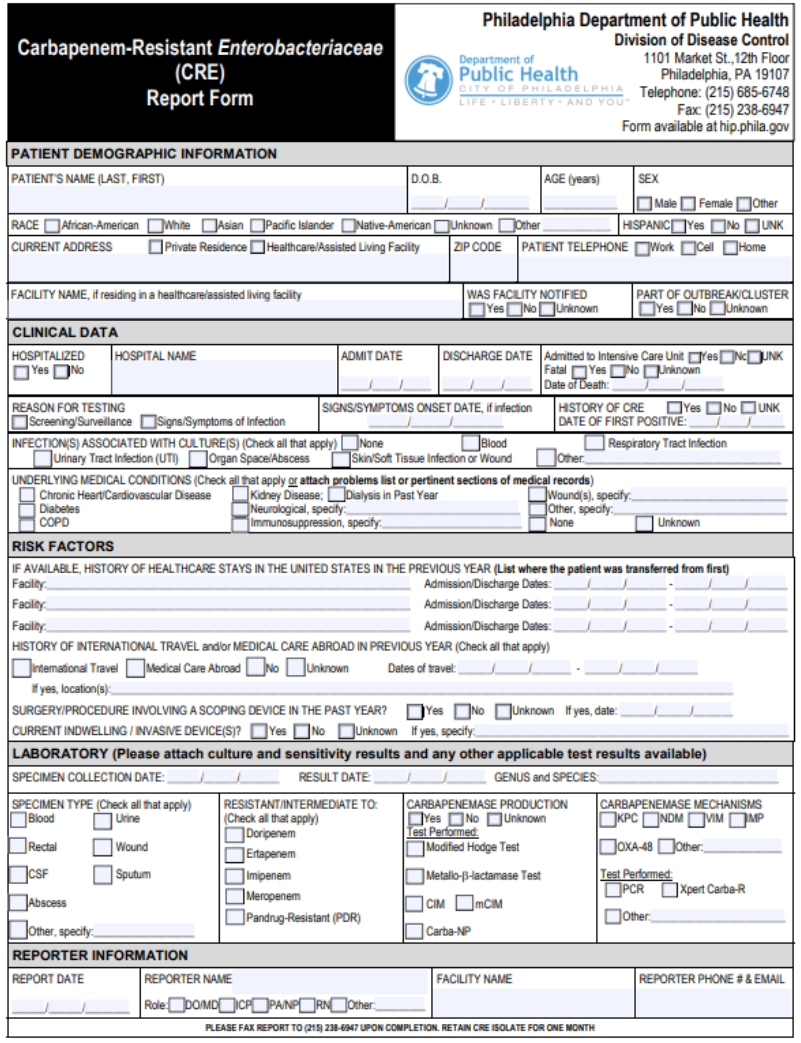
Examples of MDROs



Carbapenem-Resistant *Enterobacteriaceae* (CRE) Report Form

Philadelphia Department of Public Health
Division of Disease Control
1101 Market St.,12th Floor
Philadelphia, PA 19107
Telephone: (215) 685-6748
Fax: (215) 238-6947
Form available at hip.phila.gov

PATIENT DEMOGRAPHIC INFORMATION

PATIENT'S NAME (LAST, FIRST) | D.O.B. | AGE (years) | SEX ☐ Male ☐ Female ☐ Other

RACE ☐ African-American ☐ White ☐ Asian ☐ Pacific Islander ☐ Native-American ☐ Unknown ☐ Other | HISPANIC ☐ Yes ☐ No ☐ UNK

CURRENT ADDRESS ☐ Private Residence ☐ Healthcare/Assisted Living Facility | ZIP CODE | PATIENT TELEPHONE ☐ Work ☐ Cell ☐ Home

FACILITY NAME, if residing in a healthcare/assisted living facility | WAS FACILITY NOTIFIED ☐ Yes ☐ No ☐ Unknown | PART OF OUTBREAK/CLUSTER ☐ Yes ☐ No ☐ Unknown

CLINICAL DATA

HOSPITALIZED ☐ Yes ☐ No | HOSPITAL NAME | ADMIT DATE | DISCHARGE DATE | Admitted to Intensive Care Unit ☐ Yes ☐ No ☐ UNK; Fatal ☐ Yes ☐ No ☐ Unknown; Date of Death:

REASON FOR TESTING ☐ Screening/Surveillance ☐ Signs/Symptoms of Infection | SIGNS/SYMPTOMS ONSET DATE, if infection | HISTORY OF CRE ☐ Yes ☐ No ☐ UNK; DATE OF FIRST POSITIVE:

INFECTION(S) ASSOCIATED WITH CULTURE(S) (Check all that apply) ☐ None ☐ Blood ☐ Respiratory Tract Infection ☐ Urinary Tract Infection (UTI) ☐ Organ Space/Abscess ☐ Skin/Soft Tissue Infection or Wound ☐ Other:

UNDERLYING MEDICAL CONDITIONS (Check all that apply or attach problems list or pertinent sections of medical records)
☐ Chronic Heart/Cardiovascular Disease ☐ Diabetes ☐ COPD ☐ Kidney Disease; ☐ Dialysis in Past Year ☐ Neurological, specify: ☐ Immunosuppression, specify: ☐ Wound(s), specify: ☐ Other, specify: ☐ None ☐ Unknown

RISK FACTORS

IF AVAILABLE, HISTORY OF HEALTHCARE STAYS IN THE UNITED STATES IN THE PREVIOUS YEAR (List where the patient was transferred from first)
Facility: Admission/Discharge Dates: -
Facility: Admission/Discharge Dates: -
Facility: Admission/Discharge Dates: -

HISTORY OF INTERNATIONAL TRAVEL and/or MEDICAL CARE ABROAD IN PREVIOUS YEAR (Check all that apply)
☐ International Travel ☐ Medical Care Abroad ☐ No ☐ Unknown Dates of travel: -
If yes, location(s):

SURGERY/PROCEDURE INVOLVING A SCOPING DEVICE IN THE PAST YEAR? ☐ Yes ☐ No ☐ Unknown If yes, date:

CURRENT INDWELLING / INVASIVE DEVICE(S)? ☐ Yes ☐ No ☐ Unknown If yes, specify:

LABORATORY (Please attach culture and sensitivity results and any other applicable test results available)

SPECIMEN COLLECTION DATE: RESULT DATE: GENUS and SPECIES:

SPECIMEN TYPE (Check all that apply)
☐ Blood ☐ Urine ☐ Rectal ☐ Wound ☐ CSF ☐ Sputum ☐ Abscess ☐ Other, specify:

RESISTANT/INTERMEDIATE TO: (Check all that apply)
☐ Doripenem ☐ Ertapenem ☐ Imipenem ☐ Meropenem ☐ Pandrug-Resistant (PDR)

CARBAPENEMASE PRODUCTION ☐ Yes ☐ No ☐ Unknown
Test Performed:
☐ Modified Hodge Test ☐ Metallo-β-lactamase Test ☐ CIM ☐ mCIM ☐ Carba-NP

CARBAPENEMASE MECHANISMS ☐ KPC ☐ NDM ☐ VIM ☐ IMP ☐ OXA-48 ☐ Other:
Test Performed:
☐ PCR ☐ Xpert Carba-R ☐ Other:

REPORTER INFORMATION

REPORT DATE | REPORTER NAME Role: ☐ DO/MD ☐ CP ☐ PA/NP ☐ RN ☐ Other: | FACILITY NAME | REPORTER PHONE # & EMAIL

PLEASE FAX REPORT TO (215) 238-6947 UPON COMPLETION. RETAIN CRE ISOLATE FOR ONE MONTH

- Carbapenem-resistant Enterobacterales (CRE)
- *Candida auris (C. auris)*
- Pan-drug resistant organisms (PDRO)
- Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)
- Carbapenem-resistant *Acinetobacter baumannii* (CRAB)
- Vancomycin Intermediate/Resistant *Staphylococcus aureus* (VISA/VRSA)
- & many more

Organisms in red are reportable to PDPH. All unusual disease clusters, outbreaks, and occurrences are also reportable.

https://hip.phila.gov/document/943/CRE_ReportForm_Final_Fillable_8CnHfpL.pdf/

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Carbapenem-Resistant Enterobacterales (CRE)

- Enterobacterales are commonly found in the GI tract.
- Enterobacterales that are resistant to at least one carbapenem antibiotic (i.e., ertapenem, meropenem, doripenem, or imipenem) are called CRE.
- Infections with CRE are difficult to treat and have been associated with **mortality rates of up to 50%** for hospitalized patients.
- In 2020, CRE caused an estimated **12,700 infections** in hospitalized patients and **1,100 deaths** in the US
- CRE is transmitted from person to person, often via the hands of HCP or through contaminated medical equipment or environmental surfaces.

https://www.cdc.gov/drugresistance/pdf/covid19-impact-report-508.pdf

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CREs in Philadelphia

CRE Counts by Genus Species: April-June 2022

Genus Species	Total CRE n (%)
Klebsiella pneumoniae	19 (50)
Escherichia coli	8 (20)
Enterobacter cloacae	7 (18)
Citrobacter freundii	1 (3)
Citrobacter koseri	1 (3)
Serratia marcesens	1 (3)
Raoultella Spp.	1 (3)
Total	**38**

- Cases of CRE continue to be a concern in Philadelphia
- From July 2021 - June 2022, a total of 206 CRE cases were identified and confirmed in Philadelphia
- The most common types of CRE seen in Philadelphia are *Klebsiella pneumonia* and *Escherichia coli* which is consistent throughout other regions

CRE Resources

- PDPH CRE HIP Page
- HAI Newsletter with CRE Surveillance Report
- IPC Highlight on CRE (coming soon)

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Carbapenem-Resistant *Acinetobacter baumannii* (CRAB)

- *Acinetobacter* is a bacteria commonly found in soil and water.
- *Acinetobacter baumannii* is the most common *Acinetobacter* species to cause human infections
- *A. baumannii* can cause infections in the blood, urine, wounds, or lungs. It can also colonize mucosal surfaces, especially in the respiratory tract, and open wounds.
- In 2020, CRAB caused an estimated **7,500 infections** in hospitalized patients and **700 deaths** in the US.
- CRAB can spread in healthcare settings from person to person through contaminated hands, equipment, or surfaces.

https://www.cdc.gov/drugresistance/pdf/covid19-impact-report-508.pdf

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Carbapenem-Resistant *Pseudomonas aeruginosa (CRPA)*

https://www.cdc.gov/drugresistance/pdf/covid19-impact-report-508.pdf

- *Pseudomonas* is a bacteria that is found in soil and in water
- *Pseudomonas aeruginosa* is the most common *Pseudomonas* species to cause human infections
- *P. aeruginosa* can cause infections in the blood, lungs (pneumonia), or other parts of the body after surgery
- In 2020, CRPA caused an estimated **28,800 infections** in hospitalized patients and **2,500 deaths** in the US
- CRPA can spread in healthcare settings from person to person through contaminated hands, equipment, or surfaces.
- Those most at risk include patients in hospitals, especially those:
  - on ventilators
  - with indwelling devices
  - with wounds or burns

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Candida auris (C. auris)

C. auris is a type of yeast that has become more common in healthcare facilities:

- Often multidrug-resistant
- Colonized patients can contaminate the healthcare environment, leading to silent spread
- Many common healthcare disinfectants are not effective at eliminating *C. auris*
- **Mortality of invasive infections is ~40%** within the first 30 days.

https://www.cdc.gov/drugresistance/pdf/threats-report/candida-auris-508.pdf

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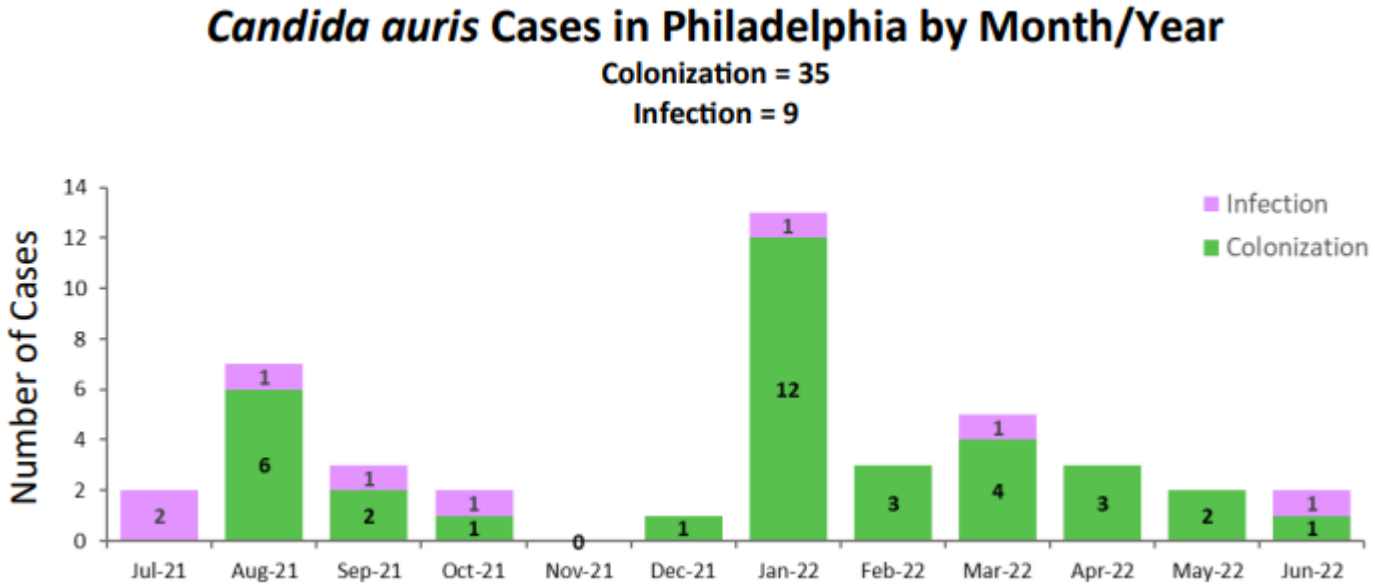
C. auris in Philadelphia

- Cases of *C. auris* are rising in Philadelphia and throughout the region
- Between March 2020 and July 31, 2022, **144 cases of *C. auris*** infection and colonization have been identified in patients in **24 healthcare facilities** across Allegheny, Bucks, Dauphin, Delaware, Lehigh, Montgomery, and Philadelphia Counties.



https://hip.phila.gov/data-reports-statistics/healthcare-associated-infections/

C. auris **Resources**

- PDPH *C. auris* HIP Page
- PDPH *C. auris* Toolkit
- PDPH/PADOH *C. auris* HAN
- HAI Newsletter with *C. auris* Surveillance Report
- IPC Highlight on *C. auris*

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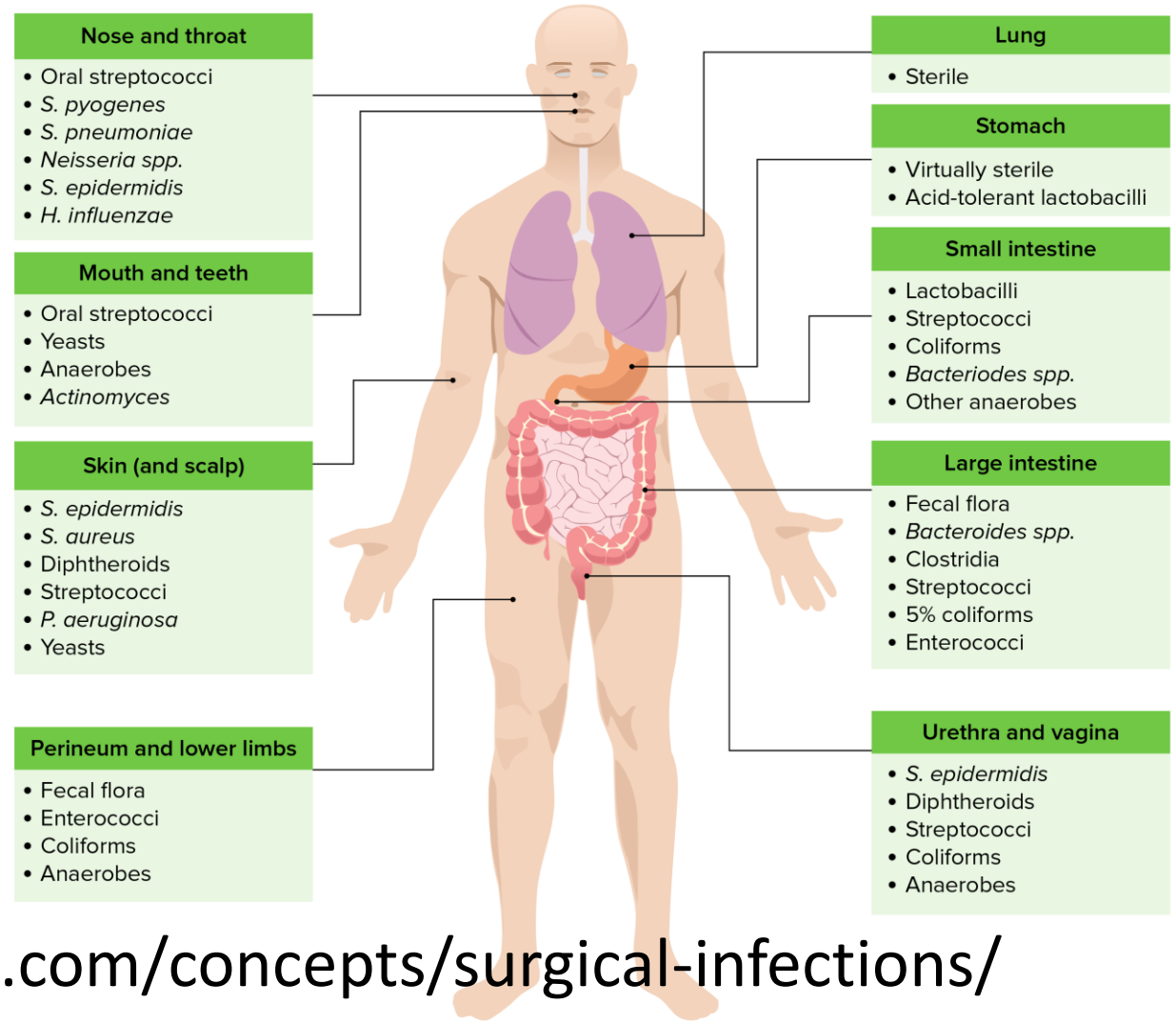
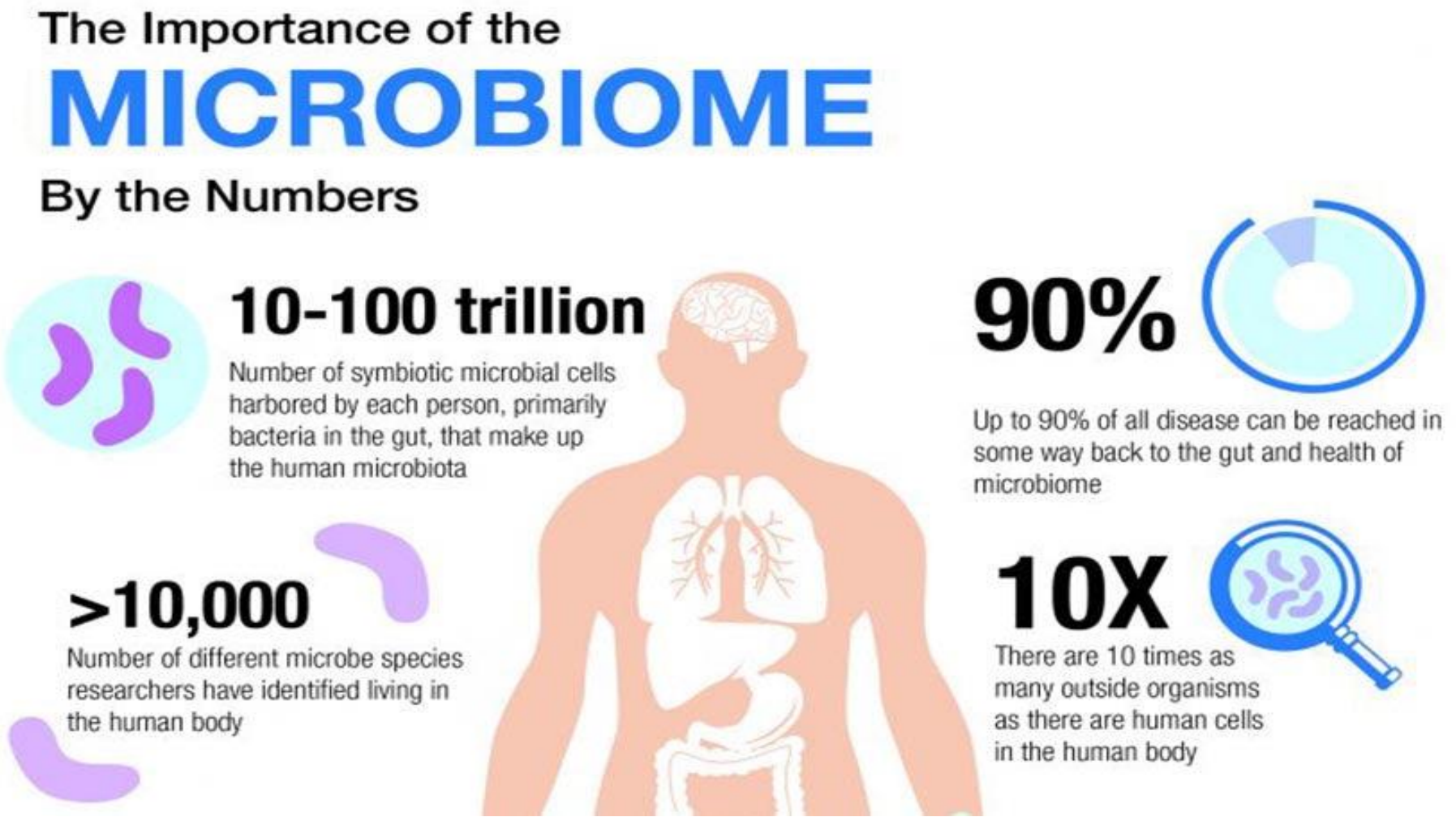
Colonization and MDRO Transmission

Sites of bacterial colonization and common colonizers

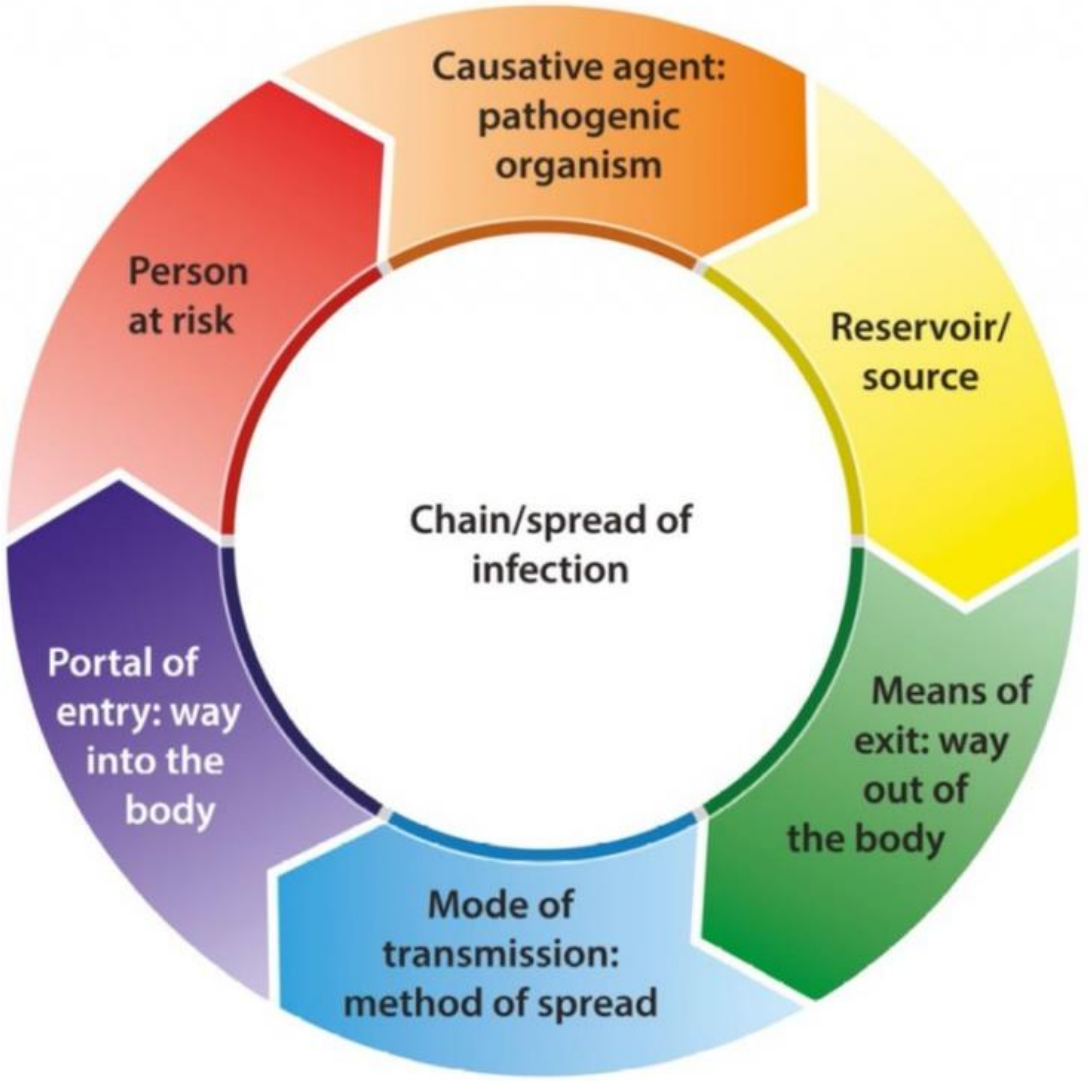


https://www.lecturio.com/concepts/surgical-infections/



https://www.scdprobiotics.com/blogs/news/the-importance-of-the-microbiome

- https://activesocialcare.com/handbook/infection-prevention-and-control/the-chain-of-infection



Key Infection Prevention Strategies **Healthcare Environment**

Audience Poll #2

Q. Can you identify some high-touch surfaces in your healthcare environment?

A. Yes

B. No

C. Not Sure

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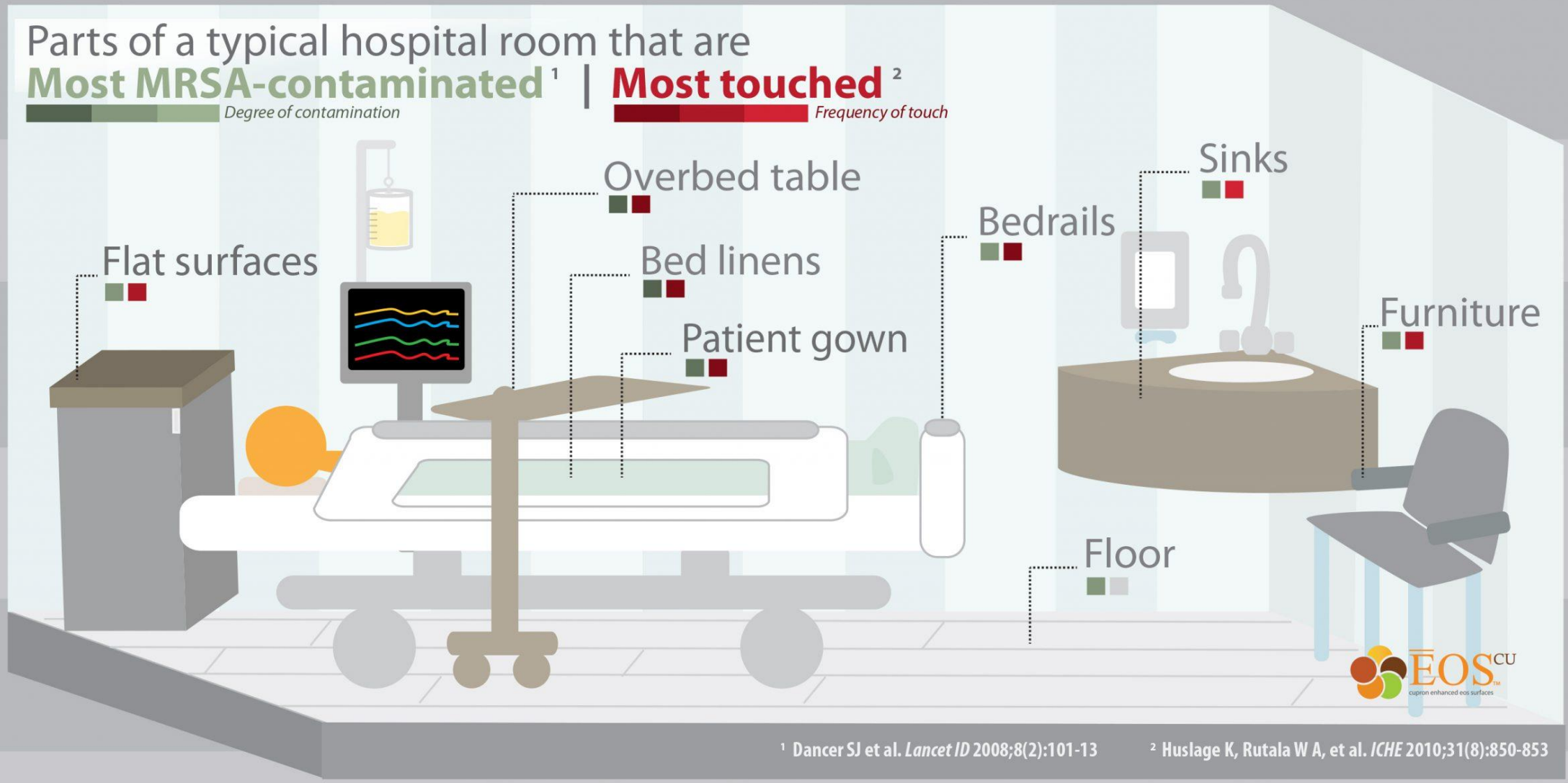
Clean Environment



[1] Dancer SJ et al. *Lancet ID* 2008;8(2):101-13 [2] Huslage K, Rutala W A, et al. *ICHE* 2010;31(8):850-853

Core Principles to Prevent Transmission

Hand Hygiene

Standard and Contact Precautions

Clean Equipment and environment

Opportunities to prevent transmission

www.mdpi.com/journal/microorganisms

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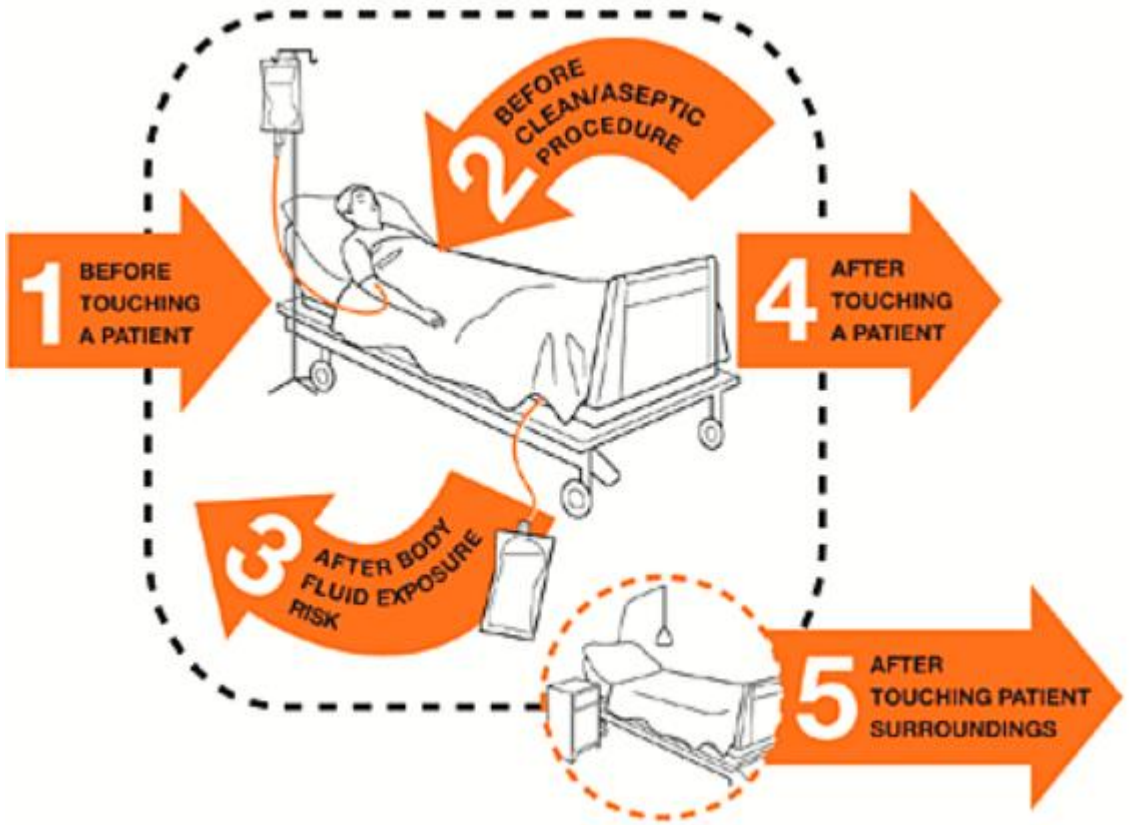
WHO's 5 Moments of Hand Hygiene



"At least 20 hospital-based studies of the impact of HH on the risk of healthcare associated infections have been published between 1977- June 2008.

Despite study limitations, most reports showed a temporal relation between improved hand hygiene practices and reduced infection and cross-transmission rates"

https://www.who.int/gpsc/5may/tools/who_guidelines-handhygiene_summary.pdf

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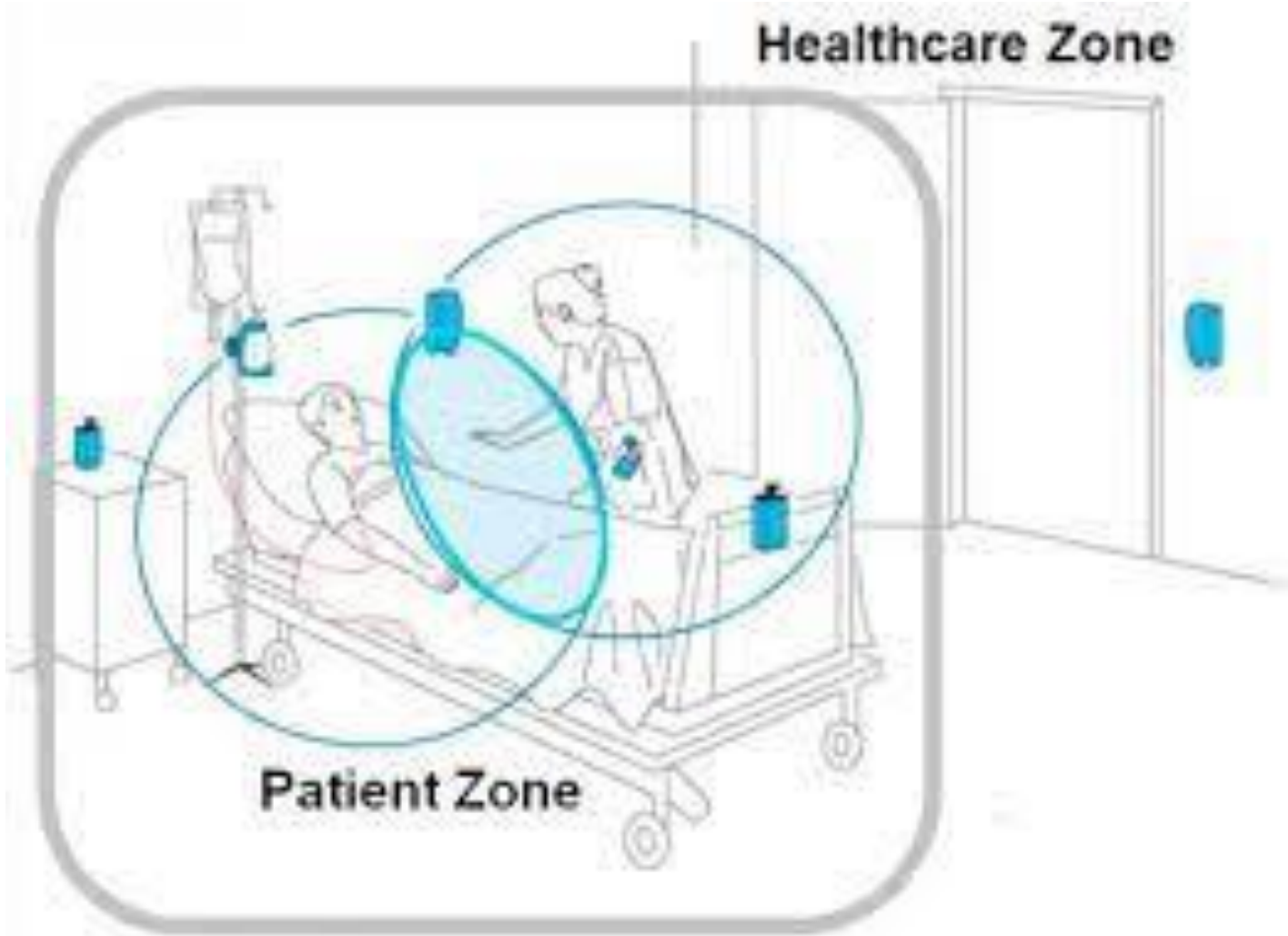
Healthcare Zone
Patient Zone

Common Hand Hygiene Gaps in SNFs

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- Staff prefer to use soap and water instead of alcohol-based hand sanitizer (ABHS)
- ABHS is not readily available, or dispensers are empty
- Only handwashing sink is in the resident's bathroom
- Gloves take the place of hand hygiene
- Misinformation regarding ABHS
- Hand hygiene audits are lacking

Audience Poll #3

Q. Does your facility have a process in place to ensure that every item in a healthcare environment is somebody's responsibility to clean, with the responsible HCW type identified?

- ❑ **Yes**
- ❑ **No**
- ❑ **Uncertain**

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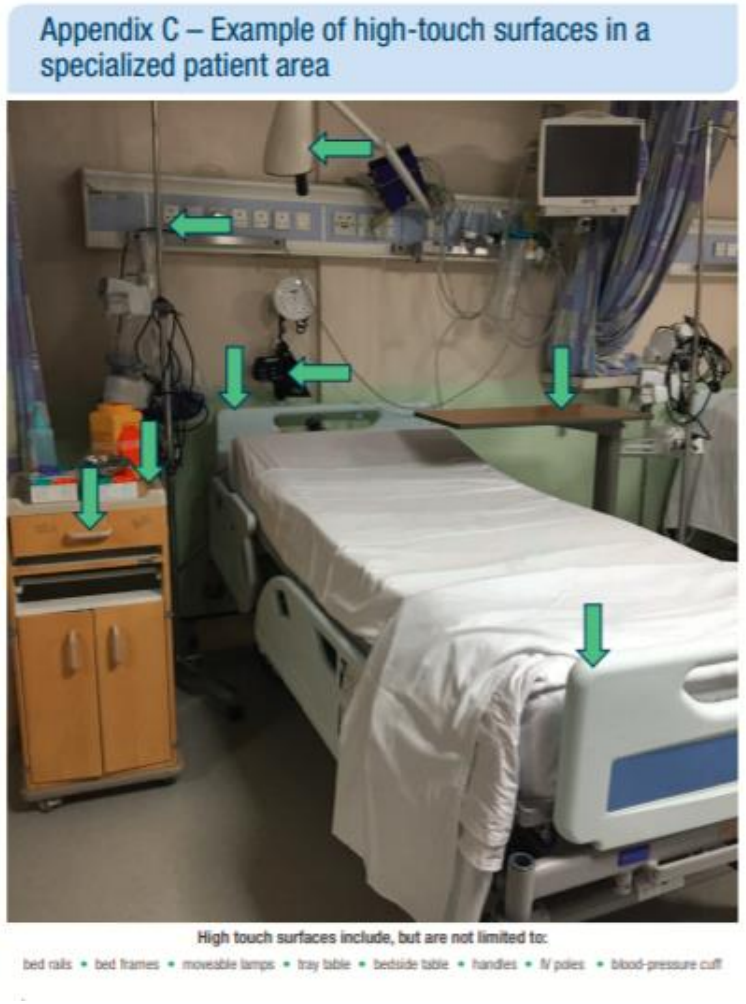
Everyone Should be Aware of



- High-touch surfaces in their area
- Correct cleaning/disinfection products
- Contact/wet times for cleaning/ disinfection products
- Importance of using good friction e.g., elbow grease
- Who cleans what
- Cleaning frequency

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Cleaning and Disinfection

An official website of the United States government Here's how you know

EPA United States Environmental Protection Agency

Search EPA.gov

Environmental Topics | Laws & Regulations | About EPA

Pesticide Registration CONTACT US

List P: Antimicrobial Products Registered with EPA for Claims Against Candida Auris

On this page:

- Products on List P
- How to use List P products effectively
- How to check if a prodcut is on List P
- Additional Resources

Products on List P

The following products are registered for use with *Candida auris (C. auris)*. EPA has reviewed laboratory testing data demonstrating that these products kill *C. auris*.

C. auris is a fungus that can cause severe infections and spreads easily between patients. *C. auris* infections tend to occur in health care settings and can be resistant to antifungal drugs.

Prior to these products being registered, there were no antimicrobial pesticides registered specifically for use against *C. auris*.

- Ensure proper product selection and processes
- Perform periodic audits
- Dedicate medical equipment whenever possible

https://www.cdc.gov/hai/toolkits/evaluating-environmental-cleaning.html

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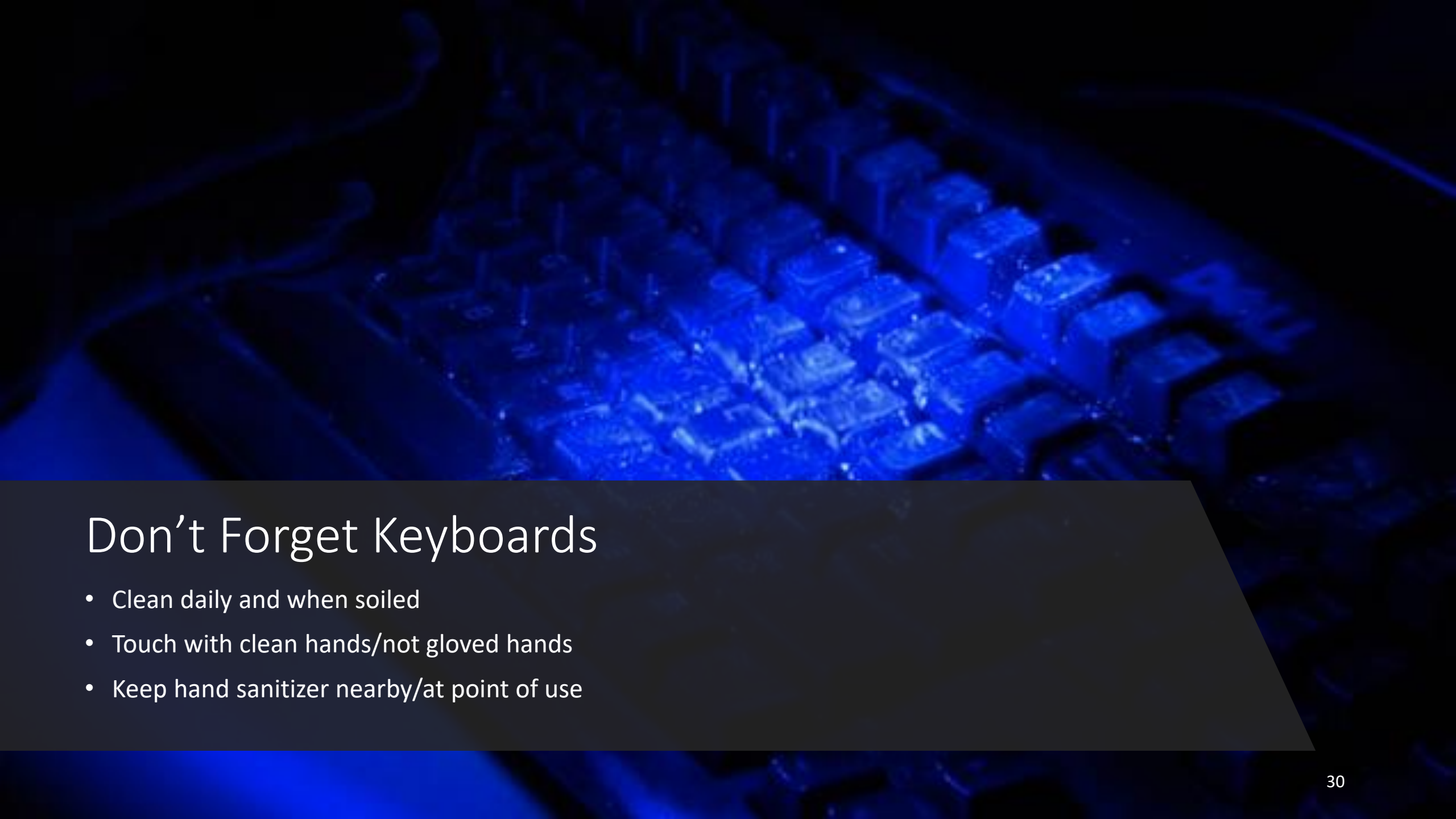
Your Cell Phone is not Part of the Resident Environment

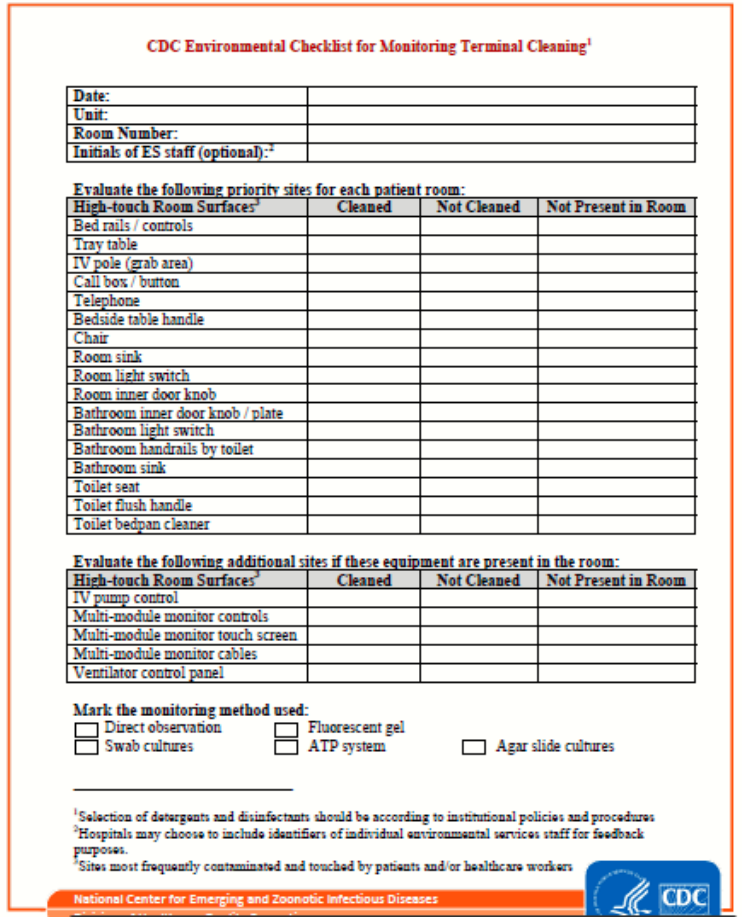
HOW MANY
GERMS
LIVE ON YOUR
CELL PHONE?



Don’t Forget Keyboards

- Clean daily and when soiled
- Touch with clean hands/not gloved hands
- Keep hand sanitizer nearby/at point of use

CDC Audit Tool



CDC Environmental Checklist for Monitoring Terminal Cleaning[1]

Date:	
Unit:	
Room Number:	
Initials of ES staff (optional):[2]	

Evaluate the following priority sites for each patient room:

High-touch Room Surfaces[3]	Cleaned	Not Cleaned	Not Present in Room
Bed rails / controls			
Tray table			
IV pole (grab area)			
Call box / button			
Telephone			
Bedside table handle			
Chair			
Room sink			
Room light switch			
Room inner door knob			
Bathroom inner door knob / plate			
Bathroom light switch			
Bathroom handrails by toilet			
Bathroom sink			
Toilet seat			
Toilet flush handle			
Toilet bedpan cleaner			

Evaluate the following additional sites if these equipment are present in the room:

High-touch Room Surfaces[3]	Cleaned	Not Cleaned	Not Present in Room
IV pump control			
Multi-module monitor controls			
Multi-module monitor touch screen			
Multi-module monitor cables			
Ventilator control panel			

Mark the monitoring method used:

☐ Direct observation ☐ Fluorescent gel
☐ Swab cultures ☐ ATP system ☐ Agar slide cultures

[1]Selection of detergents and disinfectants should be according to institutional policies and procedures
[2]Hospitals may choose to include identifiers of individual environmental services staff for feedback purposes.
[3]Sites most frequently contaminated and touched by patients and/or healthcare workers

National Center for Emerging and Zoonotic Infectious Diseases

https://www.cdc.gov/infectioncontrol/tools/index.html

- **Direct practice observation: covert, real-time**
- **Fluorescent markers: inexpensive, real-time**
- ATP detects residual bioburden
- Swab cultures: expensive, time-consuming

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Fluorescent marking

- Inexpensive
- Quick results
- Easy to use
- Confirms “elbow grease”
- PDPH provides kit with on-site education

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Monitor the Process - Before

High touch horizontal environmental surface marked with fluorescent marker – before cleaning

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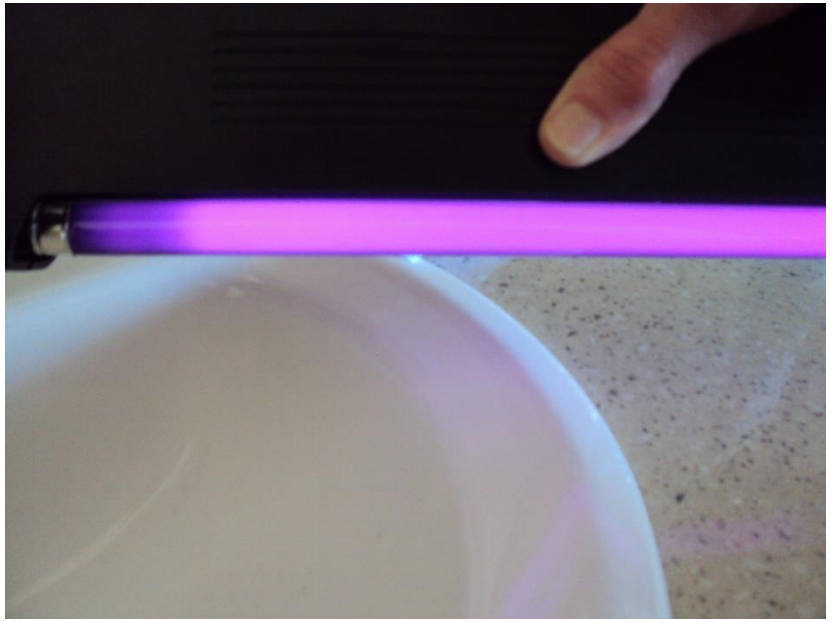
Monitor the Process - After

High touch horizontal environmental surface marked with fluorescent marker – after cleaning



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Common Environmental Gaps in LTCFs

- Disinfectant towelettes not readily available for staff use
- Staff unaware of contact/wet times for disinfectants
- Lots of shared equipment that isn't cleaned in-between use
- EVS monitoring consists of visual inspection only
- Resident belongings impede regular cleaning

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Summary

- MDROs are present on residents' bodies and throughout the environment
- Have a *C. auris* response plan
- Audit the process of environmental cleaning in resident care areas that includes **high-touch surfaces**
- Need for continued education on cleaning and disinfection for all staff
- Include EVS supervisor in your IPC Committee
- Conduct Environment of Care rounds on a regular basis