Contaminated Mobile Devices and HAI Risk

Speaker, Disclosures

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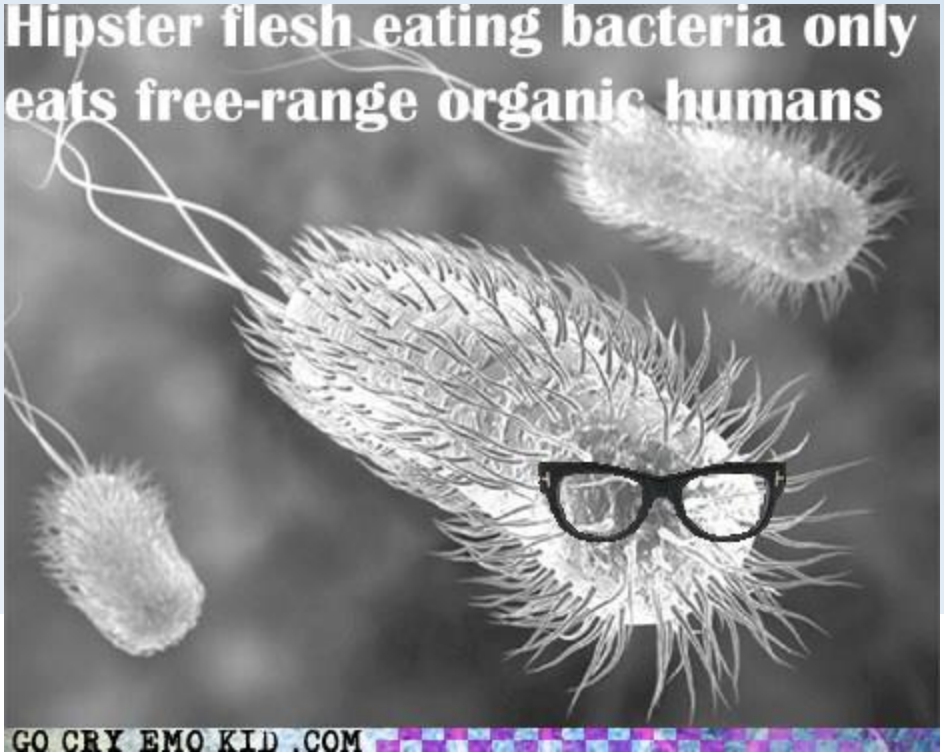
Disclosure: Speaker honorarium from PhoneSoap.

Learning Objectives

At the end of this presentation, participants will be able to:

1. Share one way in which environmentally transmitted pathogens impact HAI risk.
2. List two types of mobile electronics used daily in healthcare facilities.
3. Discuss one published study reporting contamination of hand held electronic devices and their potential role in infection transmission.
4. Describe two challenges associated with cleaning mobile devices.
5. Describe a 4 step plan to reduce the risk of contaminated mobile devices to patients in healthcare facilities.

1. Describe how environmentally transmitted pathogens impact HAI risk.



Impact of environmentally transmitted pathogens

- Environmentally transmitted pathogens = some of the most resistant to antibiotics e.g. methicillin-resistant *S. aureus* (MRSA), *Clostridium difficile*, vancomycin-resistant enterococci (VRE), multi-drug resistant *Acinetobacter.*
- *Clostridium difficile* spores, vancomycin-resistant *Enterococcus* (VRE), methicillin-resistant *Staphylococcus aureus* (MRSA) and *Acinetobacter baumannii* recovered after 4–5 months.[3]
- Patients at greatest risk = those with indwelling device(s) e.g. bladder catheters, IVs, or if they have a post operative incision.[4]

Impact of environmentally transmitted pathogens

In one study, admission to intensive care unit rooms previously occupied by carriers of methicillin-resistant *Staphylococcus aureus* (MRSA) or vancomycin-resistant enterococci (VRE) was found to confer a 40% increased risk of acquisition, presumably through environmental contamination.

Datta R, Platt R,Yokoe DS, Huang SS. Environmental cleaning intervention and risk of acquiring multidrug-resistant organisms from prior room occupants. Arch Intern Med. 2011 Mar 28;171(6):491-4.

Increased focus on environmental contamination

Increased focus on the environment's role in infection transmission in recent years due to:[1]

1. Patients acquiring antibiotic-resistant bacteria from prior hospital room occupants,
2. Increased patient illness and death from drug resistant bacteria e.g. MRSA and CDI,
3. The end of the antibiotic era is predicted due to bacterial resistance increasing faster than development of new antibiotics,
4. Reduction federal reimbursement for HAIs.[2, 15]

Drying your hands with paper towels decreases bacterial counts on hands by 45-60%, while using a hand dryer instead can increase the bacteria on your hands by how much:

A. 10%

B. 100%

C. 255%

Drying your hands with paper towels decreases bacterial counts on hands by 45-60%, while using a hand dryer instead can increase the bacteria on your hands by how much[30]

C. 255%


dyson
The fastest, most hygienic hand dryer.
WET
FLOOR

Patient Zone Microbiome

Patient zone:

1. Patient
2. Solid surfaces: bedside tables and bed rails
3. Moveable equipment which remains in room for entire patient stay: IV poles and pumps
4. Soft surfaces: gowns, bed sheets, privacy curtains, uniforms, lab coats
5. Hand held: call bells, TV remotes, and **patient cell phones (under appreciated?)**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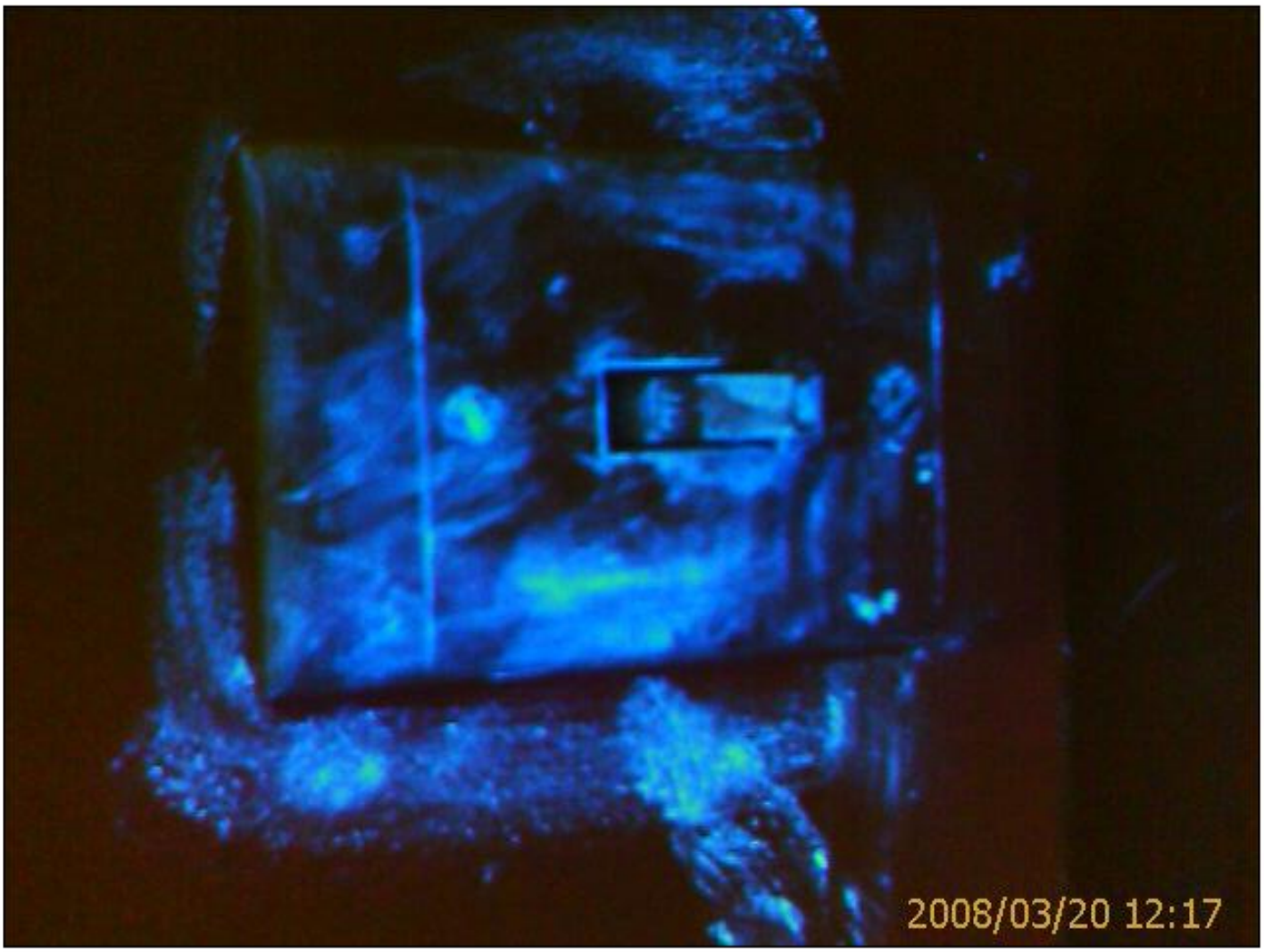
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Patient Zone Microbiome

Healthcare worker, physician, family, visitors:

1. Hands, nasal colonization
2. Gloves
3. Uniform, scrubs
4. Lab coats
5. Hand held devices – e.g. B/P cuff, stethoscope
6. **HCW mobile devices - cell phones, wireless phones, iPads**

2. List mobile electronics used daily in healthcare facilities.

Mobile electronics in healthcare

- Cell phones, pagers, tablets or iPads, Spectra-link and other portable phones and communication devices
- Patients viewing lab test results, patient reminders about upcoming appointments, video consult with physician
- Healthcare provider accessing medical records, checking lab results
- Patient education and/or a healthcare worker training.

What is the reason for increased shedding of *Staph aureus* during a cold?

A. Increased nose touching transfers *S aureus*

B. Swelling of nasal turbinates increases aerosols

C. Rhino virus transforms during flu season to *S aureus*

What is the reason for increased shedding of *Staph aureus* during a cold?

B. Swelling of nasal turbinates increases aerosols

3. Discuss published studies reporting contamination of hand held electronic devices and their potential role in infection transmission.

Role of contaminated hand held electronic devices in HAI risk

- A 2015 clinical paper reviewed thirty-nine studies on contamination of mobile phones in healthcare.[14]
- In this review, mobile phones were found to be consistently contaminated with bacteria that cause HAI.
- A primary review conclusion = use of mobile phones by healthcare workers increases contamination of hands and face; likely contributing to transmission of pathogens, including MDRO.
- In another study samples were taken from cell-phones of all hospital staff in orthopedic OR; 94% cell-phones were contaminated prior to cleaning (wiping) and 75% were contaminated after wiping.[10]

Role of contaminated hand held items in HAI risk

- In a 2017 study published in the Journal of Arthroplasty, badges, lanyards, and pagers from Orthopedic OR personnel were cultured.
- Most contamination was found on name badge lanyards, primarily growing MSSA or MRSA.
- Conclusion = operating room personnel should not use lanyards for ID badges.[11]
- In another 2017 study published in AJIC, the same strain of *S. aureus* was cultured from mobile phones and hands of nursing staff.[14]

APIC Conference 2017 Session WSOH-093. Bacterial Colonization of Mobile Phone Carried by Health-Care Providers: A Cross- Sectional Study in a Tertiary Care Teaching Hospital
Apivanich S., et al.

BACKGROUND: The aim of this cross-sectional study was to evaluate the bacterial contamination of mobile phones used by HCWs in a tertiary care teaching hospital.
METHODS: 173 mobile phones (MPs) from nurses, physicians, and medical students were screened for microbial contamination; a total of 346 cultures before and after cleaning the mobile phone with a disinfecting wipe.
RESULTS: 54% of HCWs reported never washing their hands before using MPs. The rate of bacterial contamination of MPs was 100%. Coagulase-negative staphylococcus (45%) was the most frequently isolated bacteria, followed by pathogenic bacteria 3-27% (Pseudomonas spp., *Staphylococcus aureus*, Acinetobacter spp. and *Acinetobacter baumannii*).
CONCLUSIONS: MPs can act as reservoirs of both pathogenic and nonpathogenic organisms. Transmission of pathogens can be reduced by hand hygiene and regular cleaning of MPs.

Some bacteria are psychrophilic (prefer cold), some are thermophilic (prefer hot temperatures), and many are mesophilic (prefer normal temperature ranges).
What category do most pathogenic bacteria fall into?

A. Thermophilic (hot)

B. Psychrophilic (cold)

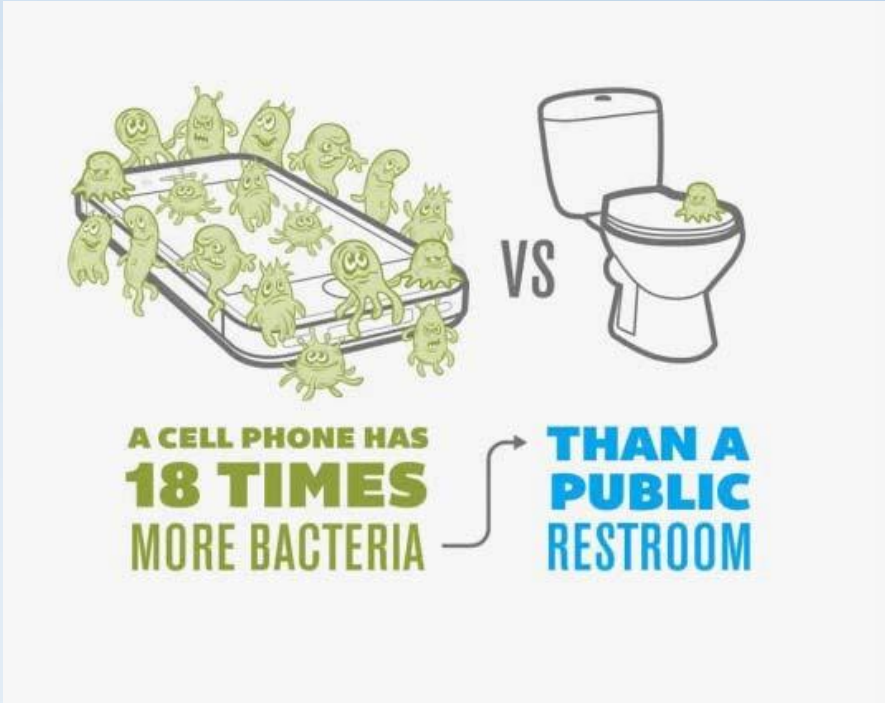
C. Mesophilic (moderate normal)

Some bacteria are psychrophilic (prefer cold), some are thermophilic (prefer hot temperatures), and many are mesophilic (prefer normal temperature ranges). What category do most pathogenic bacteria fall into?

C. Mesophilic (moderate normal)

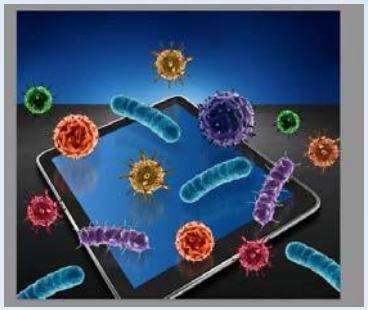
Kanayama A. et al. **"*Staphylococcus aureus* surface contamination of mobile phones and presence of genetically identical strains on the hands of nursing personnel".** American Journal of Infection Control; 45: (2017)929-31.

- Genetically identical isolates were detected from mobile phones, their user and others, demonstrating that mobile phones serve as reservoirs of bacteria in the health care environment.
- Bacterial surface contamination of mobile phones increases the risk of cross contamination between the device and the palm or fingers of health care personnel.
- Hand hygiene should be repeated after use of mobile phones and prior to patient contact.



Khan A. **"Use of portable electronic devices in a hospital setting and their potential for bacterial colonization".** American Journal of Infection Control 43 (2015) 286-8

- The study evaluated the potential contamination of portable electronic devices (PED) and associated risk factors for contamination in the hospital setting – i.e. Netbooks and tablet-based personal computers, for example iPads.
- A convenience sampling of devices in 2 large medical centers was undertaken to identify bacterial colonization rates and potential risk factors.
- All devices yielded at least 1 positive culture from the screen or cover.
- Conclusion: Portable electronic devices are increasingly being used in the hospital setting. As with other fomites, these devices represent a potential reservoir for the transmission of pathogens.



Lessons Learned from 2017-2018 Flu Season

Cell phones are capable of transferring not only messages but also disease-producing microbes including influenza virus.[24,25]

Influenza virus infection is an ongoing health and economic burden causing epidemics with pandemic potential**, affecting 5-30% of the global population annually,** and is responsible for millions of hospitalizations and thousands of deaths each year.[26]

Influenza virus may be transmitted among humans in three ways: (1) by direct contact with infected individuals **(2) by contact with contaminated objects (such as cell phones)** and (3) by inhalation of virus-laden aerosols.[27]

Anatomy of a Sneeze
https://www.youtube.com/watch?v=9qqHOKUXY5U

Cell Phones and Colonization

Constant handling + heat generated by body and phone = breeding ground for microorganisms

The average person touches their nose how many times every day, potentially then contaminating hands, environment and patients?

A. 100

B. 150

C. > 250

The average person touches their nose how many times every day, potentially then contaminating hands, environment and patients?[29]

C. >250

4. Challenges associated with cleaning mobile devices, methods currently in use to clean them and results of a recent survey.

Challenges related to cleaning hand held electronic devices

- Introduced into healthcare at a faster pace than cleaning protocols
- Frequently touched - not always with clean hands, sometimes with gloved hands
- Carried by healthcare workers ("third hand") moving from patient to patient and room to room
- Delicate functionality, can't use common cleaning and disinfection solutions
- Manufacturer's instructions for use (IFU) list products not available or not disinfectants.
- Devices can be contaminated even if not "visibly soiled".[18]

Challenges related to cleaning hand held electronic devices

- 2017 study - differences in contamination rates of mobile phones in ICU among students and other healthcare workers.
- 110 mobile phones assessed, 25% of students and 20% of all other healthcare worker = phones were clean.
- Common in both groups were coagulase-negative staphylococci (CoNS) and *Staphylococcus aureus*.
- Most HCWs cleaned phones weekly, 1/3 medical students cleaned phones several times/year.
- 40% HCWs reported alcohol disinfectant to clean phones; most medical students used a dry cloth.[9]

Challenges related to cleaning hand held electronic devices[21]

- Even when a mobile device is cleaned of fingerprints, the surface of the device may still be covered with potentially harmful bacteria. Alternatively, even when a device has been disinfected, it may not necessarily be clean.

- Regular cleaning of a device by wiping with a moist microfiber cloth may eliminate some bacteria. An additional level of decontamination is often needed to remove more dangerous and long-lasting bacteria.

- The findings of a 2011 study conclude that the mobile phones of patients and their visitors represent a distinctly "higher risk for nosocomial pathogen colonization than those carried by healthcare workers and that specific infection control measures may be required for this threat." [22]

Methods vary for cleaning and disinfecting cell phones, and tablets

- Wipe with lint free cloth
- Wipe with cloth and disinfectant solution
- Use germicidal wipe
- Rub with alcohol sanitizer
- UV disinfectant
- Nothing

Manual cleaning/disinfection of hand held electronics

One peer reviewed study[16]

- After cleaning with 5 types of wipes, the touch screens were cleared of contamination.
- Discoloration and damage were observed with Products C, V, and P.

Pros and Cons of ***Manual*** Cleaning of Mobile Electronic Devices

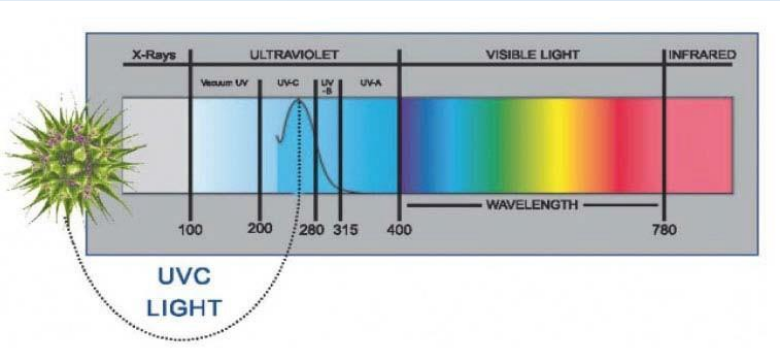
Pro's	Con's
• Wipes are widely in use in healthcare facilities	• Bleach wipes can produce an offensive odor
• Wipes are easy to use and easily accessible	• Disinfectant solutions can pit and corrode electronic and other devices
• Wipes are effective for low – intermediate level disinfection	• An average 200 bed hospital will dispose of 5 truck loads of disinfectant wipes in landfill over 10 years.
	• Two minutes is required for full wipe and dry time.
	• Human factors prevent standardized cleaning of every device every time.

Use of Add On Products to Reduce Cell Phone Contamination

- Covers and cases: Protects body not screen – some versions are antimicrobial
- Sleeves, baggies: Protects cell phones from cross-contamination and harsh disinfectants that could cause damage
- Screen protectors: Plain and antimicrobial clear adhesive film – some versions contain antimicrobial product to help reduce microbial growth

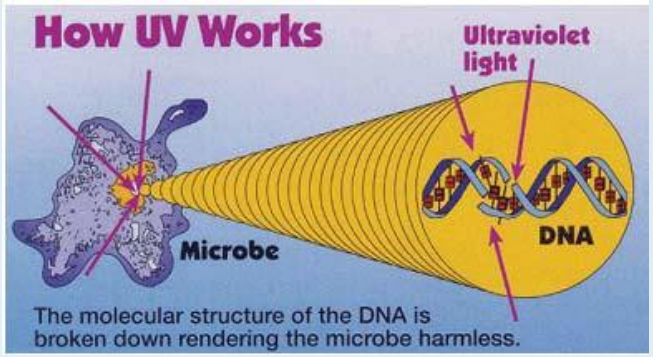
Automated Disinfection of Mobile Electronics

One study demonstrated that an enclosed ultraviolet-C radiation device was effective in rapidly reducing methicillin-resistant *Staphylococcus aureus*, and with longer exposure times, *Clostridium difficile* spores, on in-use mobile electronics.[17]



Automated Disinfection of Mobile Electronics

- UV light is frequently used as a method of environmental, water and air disinfection in healthcare.[12]
- There are three UV light wavelength categories: UV-A, UV-B andUV-C.The UV-C wavelength is the germicidal wavelength. [13]
- UV-C breaks apart the DNA - inactivates microorganisms.[13]



Novel UV Device: Automated Disinfection of Mobile Phones and Tablets

- A novel UV device has been proven to eliminate surface contamination on cell phones and iPads without damage.
- Kill claims = 99.99% of microorganisms including one mycobacterium spp.
- UV-C light does not get hot, will not damage the phone.[23]
- Studies underway at four large US medical centers, comparing efficacy of novel UV disinfection device to germicidal wipes for cell phones and tablets.[28]

Novel UV Mobile Device Disinfection Unit - Efficacy Testing[23]

- All cycles of UV light produced a 6 log reduction or better for the mixture of microbes. Suspensions of twenty-four hour cultures of *Staphylococcus aureus* (*Staph. aureus* ATCC 25923), *Escherichia coli* (E. coli 25922) *Salmonella typhimurium* (*S. typhimurium* ATCC 14028) and *Klebsiella pneumoniae* (*K. pneumoniae* ATCC 13882) Each 0.1 ml of the mixture contained 65,000,000 colony forming units (CFUs).

- All cycles of UV light produced a 6 log reduction or better for *Mycobacterium smegmatis.* Suspensions of *M. smegmatis* were made in Typtic Soy Broth (TSB) supplemented with Tween 80. Each 0.1 ml of the *M. smegmatis* suspension contained 160,000,000 CFU. *M. smegmatis* is commonly used in work on the Mycobacterium genus due to its being a "fast grower" and non-pathogenic.

Pros and Cons of ***Automated*** Disinfection of Mobile Devices

Pro's	Con's
• Proven effective 6 log reduction of pathogens in 30 seconds	• Cost
• No contact with harsh chemicals	
• Reduced wipes waste in landfill	
• Standardized reliable cleaning of every device every time	
• No damage to electronics	

Staph aureus is a pathogen that can cause many types of healthcare associated infections. What is the average % of population that is colonized with nasal *Staph aureus*?

A. 5 - 10%

B. 30-40%

C. 70 – 80%

Staph aureus is a pathogen that can cause many types of healthcare associated infections. What is the average % of population that is colonized with nasal *Staph aureus*?[16]

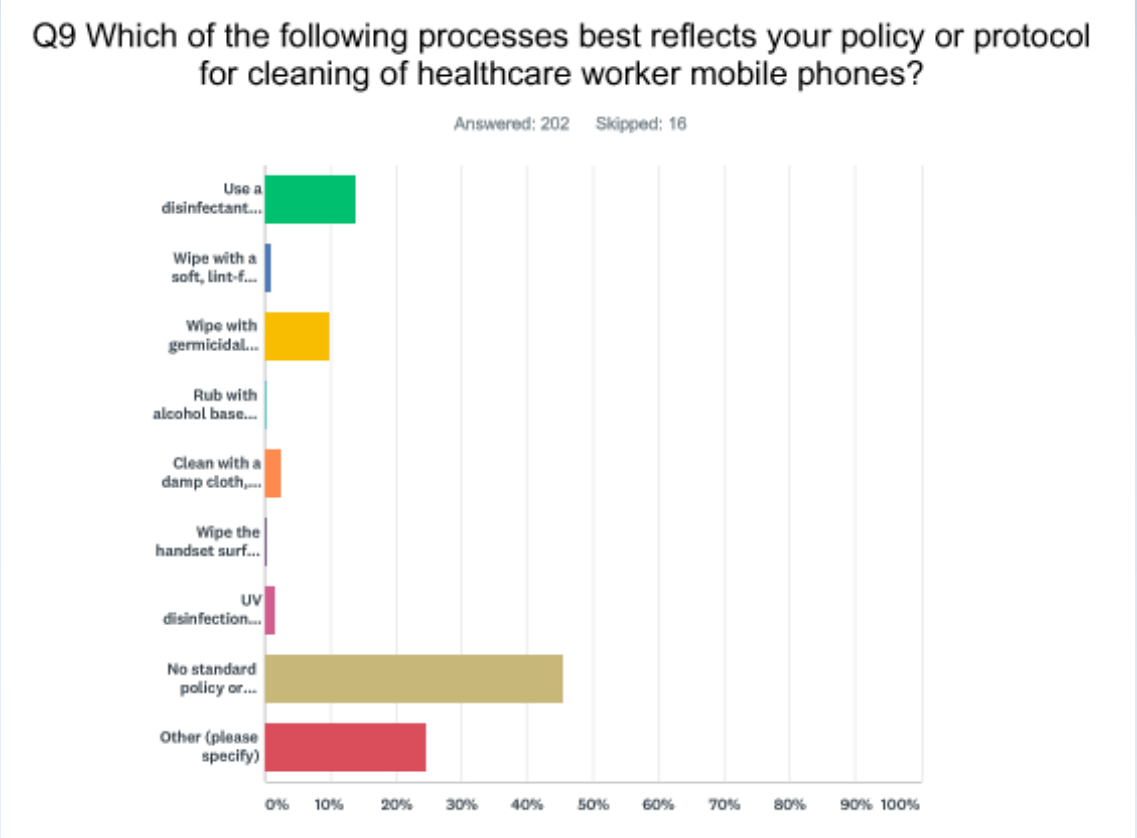
B. 30-40%

Pro & Con Summary	Germicidal Wipes	UV Device
PRO		
6 log reduction mycobacterium in 30 seconds		✓
No contact with harsh chemicals		✓
Reduced waste in landfill		✓
Standardized cleaning every device every time		✓
No damage to electronic or other hand held devices		✓
Easy to use and easily accessible	✓	✓
Low or intermediate level disinfection	✓	✓
CON		
Cost		✓
Two minutes wiping plus dry time	✓	
Damage to mobile device – voiding warranty	✓	
Offensive odor	✓	
Increases landfill	✓	
Lack of standardized use and efficacy	✓	

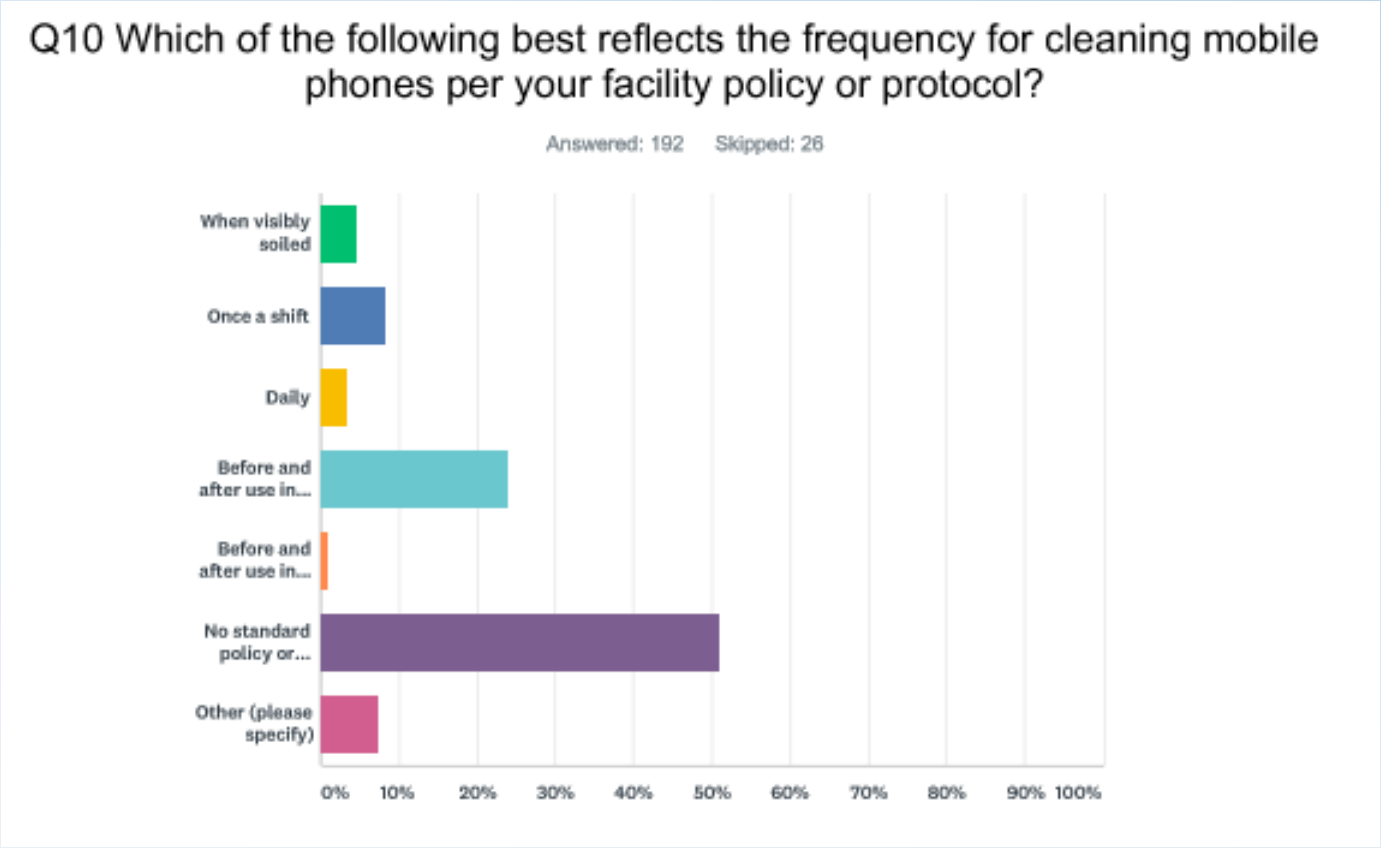
Cleaning Hand Held Electronic Devices - Current Practices: 2017 Survey of IP Professionals

- In 2017 a survey was sent to 1125 Infection Prevention professionals, 218 responded (19% response rate)
- 17 questions – Survey Monkey
- Topic: Cleaning Hand Held Electronic Devices
- **48% responded that they had no hospital policy or protocol for cleaning hand held electronic devices.**

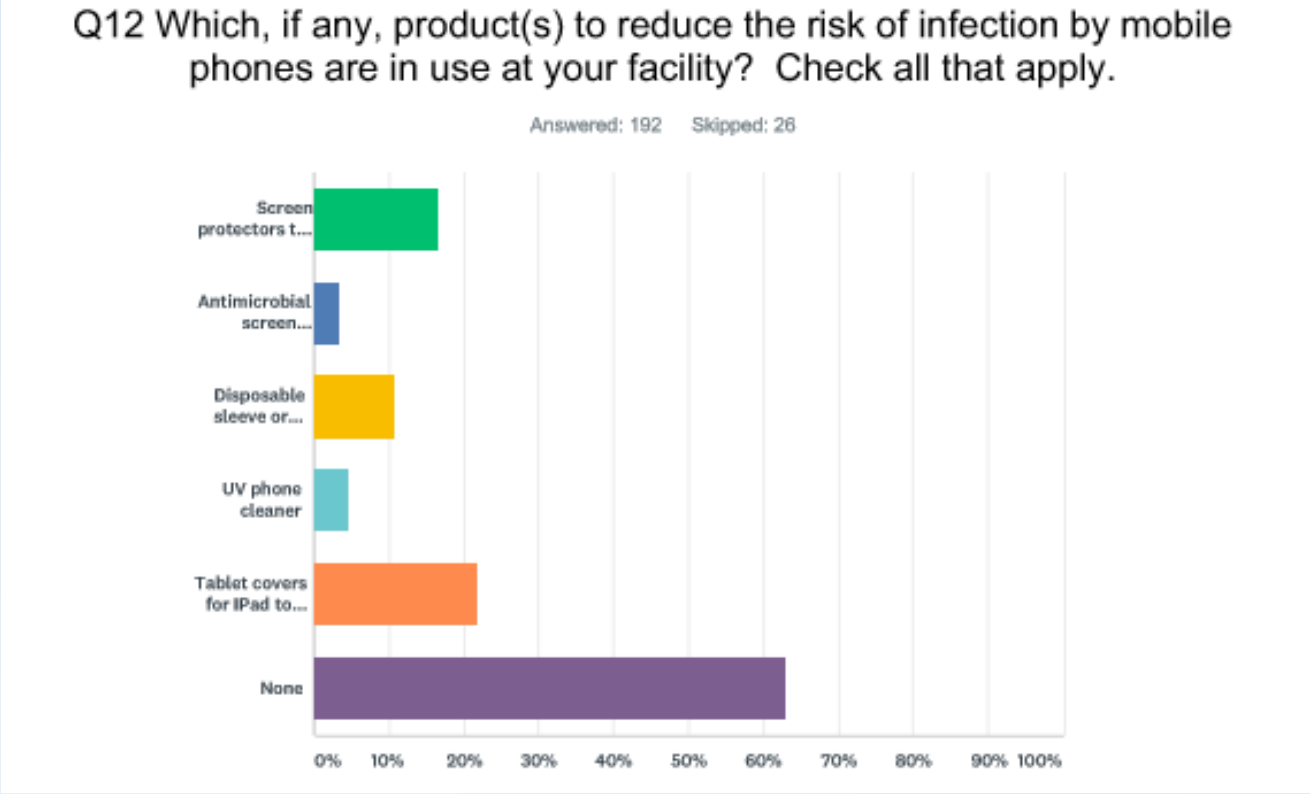
Survey Results: Processes for cleaning mobile devices



Survey Results : Frequency of cleaning mobile devices - no hospital policy or protocol



Survey Results: Use of innovative products for cleaning mobile devices - None



Three UV light wavelength categories are UV-A, UV-B and UV-C. Which wavelength is germicidal?

A. UV-A

B. UV-B

C. UV-C

Three UV light wavelength categories are UV-A, UV-B and UV-C. Which wavelength is germicidal?

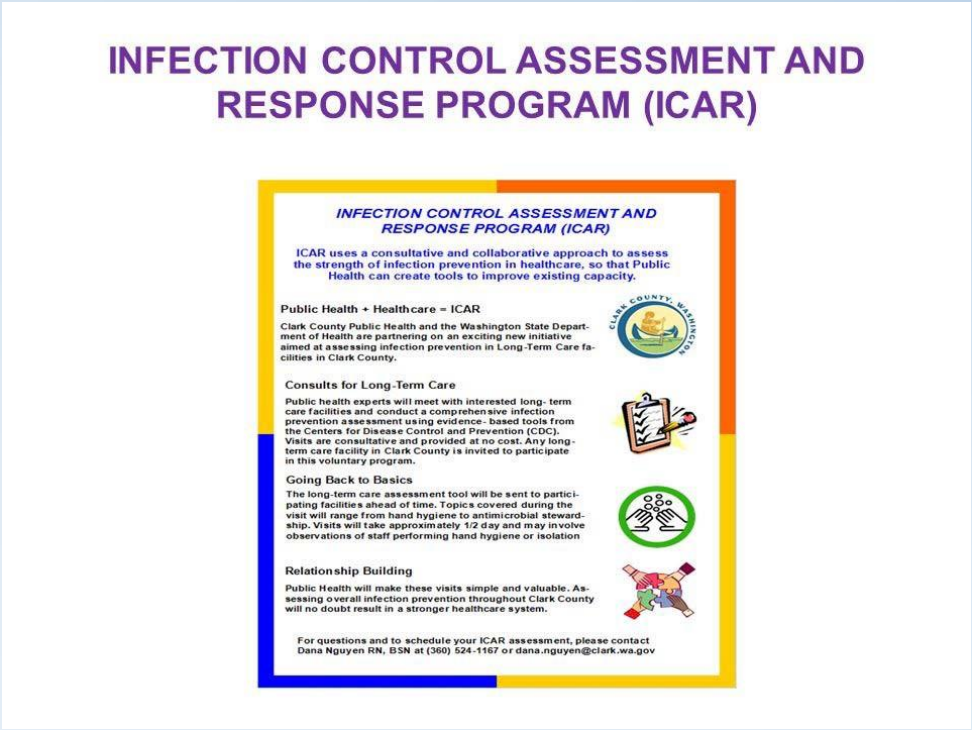
C. UV-C

5. Propose a four step plan to reduce the risk of contaminated mobile devices to patients in healthcare.

Four Step Plan to Reduce the Risk of Contaminated Mobile Devices

1. Risk Assessment to guide selection of mobile device cleaning process(es)
2. Expansion of Hand Hygiene Protocol to include cleaning/disinfection of mobile devices
3. Staff education regarding new protocol
4. Assessment of compliance

1. Risk Assessment to Guide Selection of Mobile Device Cleaning Process(es)



1. Risk Assessment to Guide Selection of Mobile Device Cleaning Process(es)

- If cell phone disinfection is approached using a risk assessment, identify areas of highest risk – i.e. Operating Room, NICU, Compounding Pharmacy, Sterile Processing, Oncology, Outpatient Infusion, Dialysis.
- Consider use of UV disinfection in highest risk areas due to: automation which increases reliability, and disinfection of visitor, healthcare worker, physician cell phones as an adjunct to the existing hand hygiene program.

Exam ple of Mobile Devi, ce Clean i1lg Risk Asse ssment

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2. Expansion of Hand Hygiene Protocol to include cleaning/disinfection of mobile devices

- Hands of HCW and mobile phone are contaminated with the same type of organisms Ulger et al. (2009)
- Recommendations to reduce infection risks associated with contaminated mobile devices commonly include strict hand hygiene. Brady, et al. (2009)
- Multiple investigators have shown that HCW mobile devices provide a known reservoir of pathogenic bacteria that can contaminate hands and be transmitted to patients. Barclay (2011)
- In one study 94% cell-phones were contaminated prior to cleaning (wiping) and 75% were contaminated after wiping.[10]
- Most people carry mobile phones along with them to places such as toilets and kitchens where microorganisms thrive. Kumar, et al. (2014)

Sample Protocol

TITLE: **Hand Hygiene and Mobile Device Cleaning/Disinfection**	Date Created: XXX

Hand Hygiene for Healthcare Providers	**Process**
1. Hand sanitizing should be performed as the preferred method of hand hygiene unless hands are soiled or when caring for patients with diarrhea.	Rub alcohol-based hand sanitizer into hands vigorously until dry according to WHO 5 moments.[6]
2. Hand washing should be performed when hands are soiled and during care of patients with diarrhea (including *Clostridium difficile* isolation)	Wash hands with soap and water for at least 15 seconds according to WHO 5 moments.[6]
Hand Hygiene for Patients	**Process**
3. Hand hygiene products must be made available to patients, families and visitors.	Hand sanitizer, hand wipes, and/or soap and water for hand washing must be readily available to patients, families and visitors. Patients must be assisted as needed to ensure regular hand hygiene throughout the day.
Mobile Device Use and Cleaning	**Process**
1. Perform hand hygiene between patient care and mobile device use. 2. Do not wear gloves during mobile device use.	Use alcohol sanitizer for non-soiled hands; soap and water for soiled hands, and *Clostridium difficile* isolation rooms between patient care and computer/mobile device use.
3. Frequency of cleaning mobile devices: ✓ Clean all tablets used for intake in Clinics, and Skyping for inpatients after each patient use ✓ Clean all provider phones (e.g., ✓ physician, surgeon, nurse, anesthesia provider) at the start and end of each shift ✓ Clean all tablets used for surgeon preference cards in OR for instrument trays every 8 hours	Use one of the following processes for cleaning/disinfection of hand held mobile devices: ✓ UV disinfection designed for hand held mobile devices – 30 second disinfection cycle time **OR** ✓ Clean thoroughly with germicidal wipe, follow manufacturer information for use including 2-4 minute dry time **AND/OR** ✓ Consider UV disinfection for high risk patient areas (e.g., OR, NICU, ICU) given studies which have demonstrated that phones may remain contaminated even after wiping[4]
4. Avoid use of mobile devices in isolation rooms.	Avoid use of mobile devices in isolation rooms.

3. Staff education regarding new protocol

4. Assessment of compliance

Conclusions

- **Microbial contamination** of the mobile phones and their increased use among the HCWs poses a significant epidemiological risk to patients in our healthcare system.
- Mobile device use is expanding at a faster pace than protocols for cleaning and disinfection, and a recent survey concludes that **cleaning is not performed consistently.**
- **A Risk Assessment** may be useful in guiding decisions regarding what process(es) to use for which patient populations/departments
- Cell phones and tablets have become extensions of the hands of healthcare workers, consequently cleaning of mobile devices may logically fit as a component of any **hand hygiene protocol/program.**

Epidemiologists

What my friends think I do

What my parents think I do

What society thinks I do

What grandma thinks I do

What I think I do

What I really do

At the End of the Day It is about….

Josh Nahum 27y’o

Josh’s Parents Victoria and Armando

•EMacario-Simon
•17 months old

My Loving
Dad- Richard

References are included on following 3 slides.

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