UV-C: A tool for disinfecting mobile devices

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Staff satisfied with cleaning workflow.

Takeaways:

- Smartphones, tablets, and other mobile devices are being used with increasing frequency in healthcare, but protocols for cleaning them aren't keeping pace.
- Published studies report significant contamination on mobile devices used in healthcare, creating potential infection risk for patients.

Mobile device (smartphone and tablet) use in healthcare continues to grow, but protocols and processes to ensure they're free from contamination haven't kept pace. These ubiquitous devices frequently are contaminated, implicating them in pathogen transmission and healthcare-associated infection (HAI) risk.

At The Women's Hospital, a 74-bed women and infant specialty hospital in southern Indiana, the infection risk posed by contaminated mobile devices came into sharp focus with the recent introduction of hospital-provided smartphones to staff and a policy change allowing staff to carry their personal phones. In addition, neonatal intensive care unit (NICU) parents are allowed to bring their phones (covered with a plastic bag) into the unit. The increased presence of mobile devices in the hospital, as well as observed variable healthcare worker

adherence with device cleaning using germicidal wipes, prompted the patient safety-infection prevention committee to trial a disinfection system that uses UV-C (ultraviolet light with a wavelengths between 200 and 280 nm) in the NICU and gynecology surgery. These departments, which are adjacent to each other, were selected because they care for patients at high risk of developing an HAI due to indwelling devices and unhealed incisions.

The research

Mobile devices have become an essential healthcare tool. Patients use their personal devices to view lab results and receive appointment reminders. Nurses, providers, and other healthcare professionals use them to access electronic health records, lab results, email, and patient education resources. In some clinics, patients use tablets to check-in.

Recent studies have shown that mobile devices used in healthcare are contaminated and inconsistently cleaned. A 5-month observational cohort study by Loyola and colleagues cultured pathogenic bacteria—multidrug-resistant *Pseudomonas aeruginosa*, *Acinetobacter spp.*, *Staphylococcus aureus*, and *Enterococcus* spp—from 491 healthcare worker smartphones in five ICUs. The study concluded that pathogens can reside on phone surfaces for prolonged periods and should be considered a potential source of HAIs in the ICU.

Currently, no standard clinical guidelines exist for cleaning mobile devices, and several manufacturers recommend against using any hospital-grade disinfectants. Many healthcare professionals use germicide-impregnated wipes to clean mobile devices. However, because the process typically isn't standardized, disinfection may be incomplete. Users might not apply sufficient friction or could miss some surface areas. They also might not allow for the required dry time, which ranges from 1 to 10 minutes. Murgier and colleagues cultured hospital staff smartphones in an orthopedic operating room and found contamination in 94% of the smartphones before cleaning (wiping) and 75% after cleaning. The recommended use of gloves with germicidal wipes also may impede proper mobile device cleaning.

Perhaps in response to these challenges, UV-C device use in healthcare is increasing. Several studies have reported on the efficacy of UV-C for reducing bioburden on healthcare environmental surfaces, with similar results for mobile devices.

The project and results

Over 2 weeks, at each end-of-day shift, the surfaces of 200 personal (NICU and gynecology surgery staff and NICU parents) and hospital-provided smartphones and tablets in the NICU were cultured before and after a 30-second cycle in a UV-C disinfection device (PhoneSoap Med+ Version 1, PhoneSoap; Provo, Utah)*.

The hospital's infection preventionists followed a protocol developed in collaboration with the microbiology director to collect culture specimens. In the laboratory, specimens were plated onto blood agar and incubated at 35° C (95° F) (plus or minus 2 degrees) for 48 hours. Growth was expressed as colony-forming units (CFU), and matrix-assisted laser desorption/ionization time-of-flight mass spectrometry was used to identify the bacteria by genus and species. (See *Mobile device contamination*.)

Mobile device contamination

The results of culture specimen collection from healthcare staff and family member mobile devices revealed a variety of contaminants. The degree of contamination was highest for staff personal cell phones, followed by (in descending order), hospital-provided phone, iPad, and parents' cell phones.

Range of colony forming units (CFU) recovered from cell phones and tablets at the beginning of shifts	10-710
Average CFU before disinfection	232
Average CFU after UV-C disinfection	< 1
Average % reduction in CFU with UV-C disinfection	99%
Most common types of bacteria recovered on phones and tablets	· *Staphylococcus epidermidis* · *Staphylococcus capitis* · other gram positive bacteria · a few gram-negative diplococci · a few fungi
The least contaminated devices	Family member cell phones
The most contaminated devices	Healthcare worker personal cell phones

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In addition, an online survey administered to staff helped determine mobile device cleaning practices prior to the study and to assess staff satisfaction after trialing the new workflow and UV-C disinfection system. The 82 survey responses revealed a wide variation in the frequency of mobile device cleaning before the study: 27% said they cleaned their devices daily and 35% said they cleaned devices at every shift. Most respondents (92%) preferred the workflow and use of the UV-C disinfection system over germicidal wipes.

The discussion

This project demonstrated that using a UV-C disinfection system effectively reduces mobile device contamination. Challenges associated with using germicidal wipes to clean mobile devices include varied application by healthcare workers, incompatibility with some devices, and 1- to 10-minute dry times. The automated UV-C system disinfects in 30 seconds and fully contains the UV light so it can be used anywhere in the hospital.

The staff survey responses concurred with the UV-C device manufacturer's recommended placement of the device, next to the handwashing sink or hand sanitizer dispenser, for simultaneous hand hygiene and device disinfection.

Although mobile devices were disinfected once at the end of each shift for this project, no professional recommendations for frequency exist. More research is needed to determine an optimal cleaning frequency.

The potential impact

The tested UV-C disinfection device, which was well received by hospital staff and patient families, provided a convenient, consistently effective method for disinfecting mobile devices. Continued use of this device is planned in the NICU and gynecology surgery unit, with expansion to additional departments. For a facility with consistently full occupancy and over 3,000 deliveries a year, the device could significantly impact infection prevention.

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*PhoneSoap Med+ devices (Version 1) were provided free of charge for the study.

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