

Mobile Phones: A Potential Source of Nosocomial Infection in the Hands of Health care Workers – A Narrative Review

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ABSTRACT

Cell phones are nonmedical portable electronic devices that are widely used by the health care workers. It remains in close contact with the body but not cleaned properly, as health care workers' may not wash their hands as often as they should and there are no guidelines regarding the cleaning of mobile phones. These mobile phones can contain multiple potential pathogens and become an exogenous source of nosocomial infection for hospitalized patients and also a potential health hazard for the family members and mobile phone owners. Studies have reported the presence of Methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant *Enterococcus* spp., *Clostridium difficile*, *Acinetobacter* spp., and norovirus. Colonized micro-organisms in the devices of health-care personnel may be transmitted to patient even if patients do not have direct contact with mobile phones. Nosocomial infection may be caused in patients with weak immune system. Hence, to prevent bacterial contamination of mobile phones, hand-washing guidelines must be followed by all the health-care workers and technical standards for prevention strategies should be developed. Regular disinfection of mobile phones is an important step in preventing cross infection.

Key words: Mobile phones, Health care workers, Nosocomial infections, Pathogens, Decontamination

INTRODUCTION

In this modern world, there is a continuous progression in technology. We have personal computers, mobile phones, mobile handheld devices, and laptops. Mobile phones serve as an essential means of communication, so there is a widespread use of mobile phones by healthcare as well as non-health care workers. In the clinical setting, most health-care professionals use cell phones for urgent contact during emergencies, rounds, and also in operating theaters and intensive care units (ICUs).^[1,2]

A hospital-acquired infection, also known as a nosocomial infection, is an infection that is acquired in a hospital or other health care facility. The infection can originate from the outside environment, another infected patient, staff that may be infected, or in some cases, the source of the infection cannot be determined. Physicians and other health-care personnel working in ICUs and operating units have high exposure to the deadly micro-organisms. Cell phones can function as infection reservoirs, allowing contaminating bacteria to be transported to several different clinical settings and directly encouraging the dissemination of potentially pathogenic bacteria to the population.^[3]

Several bacterial species have been detected on mobile phone surfaces used in clinical as well as non-clinical settings and there

is no guidance on how to mitigate contamination, regardless of having evidence that these devices can harbor pathogenic micro-organisms. The mobile phones are rarely cleaned and are frequently contaminated during or after patient assessment and specimen handling without adequate hand washing.^[4] These mobile phones can contain multiple potential pathogens and become an exogenous source of nosocomial infection for hospitalized patients and also a potential health hazard for the family members and mobile phone owners. In a study, the average mobile phone is found dirtier than either a toilet seat or the bottom of your shoe.^[5]

Few studies have reported the presence of epidemic viruses such as influenza virus, rotavirus, metapneumovirus, and syncytial respiratory virus on healthcare workers' mobile phones.^[6]

Bacterial contamination of mobile phones

Studies suggest that the *Staphylococcus aureus*, (CoNS) coagulase negative *Staphylococcus*, *Pseudomonas* species, *Micrococcus* species,

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and *Escherichia coli* isolated from surfaces of mobile phone carried the most common health risk.^[7,8] These organisms are known pathogens and cause various infections such as food poisoning, infections of the wound, and other types of infections. In one of the reports, 53 phones of orthopedic surgeons had 83% pathogenic bacteria the same as that found at the surgical site of the infection of the patients and it was observed that the bacterial contamination reoccurred after 1 week of disinfection with wipes.^[9] The bacterium found on the cell phones of health-care personnel varies depending on the type of working ward and region. Such situations catalyze the cross-contamination in hospitals.^[10-13]

Certain studies have reported the presence of drug-resistant pathogenic organisms over mobile phones. In a study, around 95% of the cell phones of health-care personnel from a hospital were contaminated with 52% of antibiotic-resistant species of bacteria. The bacterial composition on the phones was a reflection of the hand microbiota of the sampled health care workers.^[14]

In a study conducted by Ustun and Cihangiroglu, bacterial contamination on screened phones was found to be 98%. About 10% of the collected samples were contaminated with methicillin-resistant *Staphylococcus aureus* (MRSA), while 11% with *E. coli*.^[15] These bacteria are primarily responsible for the spread of nosocomial infections and pose a major health hazard to infants and other patients with immune suppression, including old, diabetic patients, patients with burn, and cancer.^[16]

Several studies have shown the bacterial contamination of preclinical students' mobile phones at medical universities. Both pathogenic and non-pathogenic bacteria, including coagulase negative *Staphylococcus* (68%), *Staphylococcus aureus* (16.2%), *Viridans streptococci*, *Bacillus* species, and *Pantoea* species, were found.^[16] The results of this study indicated a significantly higher proportion (three-fold) of contamination on the cell phones of clinical students with *S. aureus* (77.8%) and MRSA (20.0%) than the preclinical students. Furthermore, numerous other types of species of bacteria were isolated, including *Acinetobacter* species, *Streptococcus pneumoniae*, *Staphylococcus epidermidis*, *Pseudomonas aeruginosa*, and *Candida albicans*. The authors attributed the presence of MRSA and *S. aureus* to the hospital environment and emphasized the importance of phone hygiene.^[17]

A variety of bacterial species associated with nosocomial infections have been isolated and tested for their resistance to antimicrobials. In most of the collected samples, coagulase negative *Staphylococcus*, *S. aureus*, *Pseudomonas* sp., *E. coli*, and *S. epidermidis*, along with different patterns of drug resistance species, were predominant. Some authors said that if the mobile phones are not cleaned at regular intervals, they can serve as a source of hospital cross-contamination as they are highly contaminated.^[18]

The pediatric wards have high morbidity and mortality rates due to cross-infection. To determine the bacterial contamination of mobile phones of health care workers operating in pediatric ICUs, a study was conducted. Out of 491 mobile phone samples from three hospitals, 104 phones were contaminated with *Enterobacteriaceae*, with a high prevalence of bacterial species developing antibiotic resistance genes and producing extended-spectrum β -lactamase

such as *Klebsiella pneumoniae* and *E. coli*. These antibiotic-resistant bacteria are a major threat to the patients and play a major role in hospital-acquired infections in pediatric and neonatal ICUs.^[19,20]

RISK OF NOSOCOMIAL INFECTION IN DENTAL PRACTICE

Oral cavity serves as a natural habitat for large number of microorganisms. Studies have shown that many infectious substances can survive for a long time if they are not removed by surface disinfection. In addition, the presence of saliva in dentistry and contamination with dangerous microbes has repeatedly exposed patients and doctors to several pathogenic microbes. Dental procedures involve use of a high-speed handpiece or ultrasonic instruments that produces a large number of droplets and aerosols generation with saliva and blood. As a result, dentists' incidence of infectious diseases is higher than that of regular population and other medical staff.

Due to the high temperature and moisture content of the operatory, mobile phones are ideal for microbial growth. Mobile phones as a fomite can lead to community-acquired infections with potential consequences for public health. Many studies showed that coagulase-negative *Staphylococcus* spp., *Bacillus* spp., *Pseudomonas* spp., *Micrococci* spp., *Acinetobacter* spp., and *Staphylococcus citreus* and *Diphtheroids*, as well as non-methicillin-resistant *S. aureus* and vancomycin-resistant *Enterococci* spp were the most commonly found bacteria on mobile phones. Opportunistic pathogens, such as *Janthinobacterium* spp., and *Pseudomonas* spp. were isolated from the dentists' and dental hygienists' phones. Furthermore, *Enterococcus* spp. and *Stenotrophomonas* spp. known to cause severe nosocomial infections, *Streptococcus* species associated with oral disease and *Acinetobacter*, a multidrug resistant opportunistic pathogens have also been identified.^[21]

Haemophilus spp., which can cause a fatal respiratory infection, and *Neisseria* spp., which can cause gonorrhoea and septicemia, have been reported on the mobile phones. Besides this, *Fusobacterium* spp., *Actinomyces* spp., *Streptococcus* spp., and *Porphyromonas* spp., believed to be associated with different oral diseases, have been detected.^[22]

DECONTAMINATION STRATEGIES

Antibacterial wipes

Several forms of antibacterial wipes are widely available to clean mobile devices. Wipes that are moistened with either plain water or saline can effectively reduce the bacterial count through mechanical removal.^[19]

Wipes moistened with 70% isopropyl alcohol are remarkably effective in decontaminating cell phone surfaces.^[23,24]

Antibacterial screens

Antibacterial silver-based glass for smartphones and other touch screen devices,^[25] it can inhibit bacterial growth and activity and even cause the death of microbes.

Light-activated antimicrobial agents (LAAAs) are materials that exert an antimicrobial effect through the generation of reactive radical species on exposure to light of an appropriate wavelength. LAAAs have shown adequate efficacy in reduction of the bacterial load on screens of the mobile phone with minimal efforts of the user. However, as their disinfection efficiencies are not sufficiently effective for cases and covers of phones, they can offer protection to a certain degree only.

Ultraviolet (UV) light-based disinfection

Recently, the disinfecting effect of UV radiation on mobile phones has been investigated. To improve decontamination, the intrinsic antibacterial properties of UV light have been intensively investigated.^[25]

In UV irradiation, an object is treated with light of a wavelength around 254 nm which terminates the reproduction and growth of the microbes by the destruction of nucleic acids.

Several commercially available UV-based phone sanitizers have been introduced, namely IQ MOBILE™ (LED Suutari), SETi (Sensor Electronic Technology Inc.), CleanSlate™ UV Sanitizer, PhoneSoap 2.0, Easycare®, Sonitech, LEAD YOUNG®, and Codonics D6000. These sanitizers consist of a compartment that is fitted with a UV light source; the mobile phone is positioned into this compartment for a few minutes to eliminate the microbes.

CONCLUSION

Today, mobile phones are essential equipment for doctors. Since restrictions on cell phone usage in hospitals are not a realistic solution. Daily and appropriate hand washing is the single most important aspect that can minimize cell phone contamination;^[3] also, mobile phones can be decontaminated with alcohol disinfectant wipes (with 70% isopropyl alcohol).^[23] Hence, it can be concluded that the isopropyl alcohol-based antibacterial wipes and advanced UV-cabinets can be used more regularly at certain time intervals for effective mobile phone disinfection.

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