

Short Communication

Peril, risks and danger of infectious diseases from mobile phones

Dr. Bharathi Purohit, MDS and Dr. Abhinav Singh, MDS

Assistant Professor - Department of Public Health Dentistry, People's College of Dental Sciences, Bhopal – India
Assistant Professor - Department of Public Health Dentistry, ESIC Dental College & Hospital, Rohini – New Delhi
Under Central Ministry of Labour & Employment - Government of India

Received November 9, 2011; Accepted January 19, 2012

Nosocomial infection is an important problem in all modern hospitals. Unlike our hands, which are easily sterilized using hand sanitizers made available readily across all hospitals and medical facilities, our mobile phones are more cumbersome to clean. Even we rarely make an effort to sanitize them. As a result, these devices carry a variety of bacteria. The use of cell phones often occurs in hospitals, by patients, visitors and health care workers, and this is one environment where hospital-associated infection is most prevalent. Everyone should clean their cell phones, but especially doctors, dentists and nurses whose hygiene impacts the patients well-being.

Key words: Infection control practices, mobile phones, hospital based settings, dental clinics, new threats on the horizon

INTRODUCTION

The global system for mobile telecommunication (GSM) was established in 1982 in Europe with a view to providing and improving communication network. The first use of mobile phone in India was in 1995 and today 287 million mobile phone users in India which account for 85% of all the telecommunication users.¹ With the advancement in technology, mobile era has evolved and the world is on the tip of finger. Today, mobile phones have become one of the most indispensable accessories of professional and social life. Although they are usually stored in bags or pockets, mobile phones are handled frequently and held close to the face.²

Hospital-acquired infections affect more than 25 percent of admitted patients in developing countries. In U.S. hospitals, they cause 1.7 million infections a year and are associated with approximately 100,000 deaths. It is estimated that one third of these infections could be prevented by adhering to standard infection control guidelines.³

Germ prone

Cell phone and smart phones increasing functionality and affordable prices have resulted in a global wide reliance on staying connected. Cell phones are now commonplace whether it be the dinner table, the kitchen, a restaurant, the gym, or even the bathroom. These factors and the heat generated by cell phones, contribute to the harboring of bacteria on the device at alarming levels and when we consider a cell phone's daily contact with the face, mouth, ears and hands, the dire health risks of using germ infested mobile devices are obvious.

Unlike our hands, which are easily sterilized using hand sanitizers made available readily across all hospitals and medical facilities, our mobile phones are more cumbersome to clean. Even we rarely make an effort to sanitize them. And, as a result, these devices carry a variety of bacteria. The use of cell phones often occurs in hospitals, by patients, visitors and health care workers, and this is one environment where hospital-associated infection is most prevalent.⁴

Bacterial infections in healthcare workers and corporate users

A study was conducted in Southern India to determine whether mobile phones of healthcare workers (HCWs) and corporate users harbour micro-organisms. Swabs collected from mobile phones were inoculated in solid and liquid media, and incubated aerobically. Growth was identified as per standard microbiological procedures. Antibiotic susceptibility was determined for *Staphylococcus aureus*. A questionnaire was used for data collection on awareness of mobile phone use. Of 51 HCWs and 36 corporate mobile phones sampled, only 5 (6%) showed no growth. Pathogens isolated from HCW samples included *S. aureus* [methicillin-sensitive *S. aureus*, methicillin-resistant *S. aureus*], *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. Coagulase-negative Staphylococci were also isolated. Among corporate isolates, 29% were pathogenic. Polymicrobial growth was detected in 71% of HCW and 78% of corporate mobile phones. Only 12% of HCWs used disinfectants to wipe their mobile phones. Therefore it was concluded that mobile phones serve as a ready surface for colonisation of nosocomial agents indicating the importance of hand hygiene to prevent cross-transmission.⁵

Hospital based patients

The first study of bacterial contamination of mobile phones was conducted in a teaching hospital in Turkey with a bed capacity of 200 and one intensive care unit.⁶ One-fifth of the cellular telephones examined in a study conducted in New York were found to harbor pathogenic microorganisms.⁷ Healthcare workers' mobile phones provide a reservoir of bacteria known to cause nosocomial infections. UK National Health Service restrictions on the utilization of mobile phones within hospitals have been relaxed; however, utilization of these devices by inpatients and the risk of cross-contamination are currently unknown. Demographics and characteristics of mobile phone utilization by indoor patients and phone surface microbial contamination was examined by Brady et al. 102 out of 145 (70.3%) indoor patients who completed a questionnaire detailing their opinions and utilization of mobile phones, also provided their mobile phones for bacteriological analysis and comparative bacteriological swabs from their nasal cavities; 92.4% of patients support utilization of mobile phones by indoor patients; indeed, 24.5% of patients stated that mobile phones were vital to their stay. Patients in younger age categories were more likely to possess a mobile phone both inside and outside hospital ($p < 0.01$) but there was no gender association. 86 out of 102 (84.3%) patients' mobile phone swabs were positive for microbial contamination. 12 (11.8%) phones grew bacteria known to cause nosocomial infection. 7 (6.9%) phones and 32 (31.4%) nasal swabs demonstrated *Staphylococcus aureus* contamination. MSSA/MRSA contamination of

phones was associated with concomitant nasal colonization. Patient utilization of mobile phones in the clinical setting was popular and common.⁸

A cross-sectional study was conducted in Turkey to determine bacterial colonization on the mobile phones used by patients, patients' companions, visitors, and health care workers (HCWs). Significantly higher rates of pathogens (39.6% versus 20.6%, respectively; $P = .02$) were found in mobile phones of patients' ($n = 48$) versus the healthcare workers ($n = 12$). There were also more multidrug pathogens in the patients' mobile phones including methicillin-resistant *Staphylococcus aureus*, extended-spectrum β -lactamase-producing *Escherichia coli*, *Klebsiella* spp, high-level aminoglycoside-resistant *Enterococcus* spp, and carbapenem-resistant *Acinetobacter baumannii*. Findings suggest that mobile phones of patients, patients' companions, and visitors represent higher risk for nosocomial pathogen colonization than those of HCWs. Specific infection control measures may be required for this threat.⁹

In Nigeria, there has been an increase in the use of mobile phones among the general population, and the use of phones is common in certain areas of the environment where the percentage presence of bacteria is likely high, such as in hospitals, in animal slaughter areas, and in toilets. A study was conducted to determine whether mobile phones could play a role in the spread of bacterial pathogens and to proffer possible control or preventive measures that could be instituted to avoid this likely vehicle of infection. In this study, 62% of 400 mobile phones from all the study groups were found to be contaminated by bacterial agents. Isolation of bacterial agents from electronic devices such as handheld computers and personal digital assistants has shown these devices to be possible modes of transmission of nosocomial pathogens.¹⁰ In a study conducted in Queen Elizabeth hospital in Barbados, West Indies, over 40% of mobile phones of 266 medical staff and students were culture positive.¹¹ Ulger et al. reported that 94.5% of 200 health care workers and their mobile phones were contaminated with various microorganisms, including nosocomial pathogens, in a study conducted in New York and Israel.¹²

Nosocomial infection is an important problem in all modern hospitals. As early as 1861 Semmelweis demonstrated that bacteria were transmitted to the patients by the contaminated hands of healthcare workers. Hospital operating rooms and intensive care units are the workplaces that need the highest hygiene standards, also the same requirements for the personnel working there and the equipment used by them.¹³ Rusin et al. had documented both gram-positive and gram-negative bacteria in the hand-to-mouth transfer during casual activities. This implies that mobile phones may serve as vehicles of transmission of diseases such as diarrhoea, pneumonia, boils, and abscesses.¹⁴ A study

was conducted in Turkey to determine the contamination rate of the healthcare workers' (HCWs') mobile phones and hands in operating room and ICU. These results showed that HCWs' hands and their mobile phones were contaminated with various types of microorganisms.¹⁵

Dental Clinics

A cross-sectional study was conducted in India to determine the level and type of bacterial contamination of the mobile phones of dental personnel involved in direct patient care and to determine the usefulness of cleaning with 70 percent isopropyl alcohol for decontamination. Dental faculty and trainees in an Indian dental school were asked to participate in a study in which a questionnaire concerning patterns of mobile phone use and disinfection was administered. Swabs from mobile phones of the participants were taken using moist sterile swabs and plated on blood agar plates. The bacteria isolated were identified by biochemical tests. Eighteen percent of the participants (n=9) reported using their phones while attending patients. Nearly 64 percent (n=32) used their mobiles for checking time, and 64 percent (n=42) reported never cleaning their phones. In total, fifty mobile phones were cultured for microorganisms: 98 percent (n=49) were culture-positive, and 34 percent (n=17) grew potentially pathogenic bacteria. There was significant reduction in the mean number of colony-forming units after decontamination with alcohol ($p < 0.001$). The bacterial load was reduced by around 87 percent. The results of this study show that mobile phones may act as an important source of nosocomial pathogens in the dental setting. Therefore, it is important for dental school administrators to encourage higher compliance with hand-washing practices and routine surface disinfection through framing of strict protocols to reduce the chances of occurrence of nosocomial infections.¹⁶

Creating a Policy

What we need is a sound and feasible policy with respect to mobile phone usage in hospital settings. Today mobile phones are important devices for both the professional and social lives of their users. However, restrictions on the use of mobile phones in certain areas of the environment where the percentage presence of bacteria is likely high (such as in hospitals, dental clinics, lecture theatres, canteens, business centres, toilets and other such places) is difficult and thus not a practical solution. Users of mobile phone hence need to be advised to use antibacterial wipes to make their mobile phones germ free at all times. Also, strict adherence to infection control and precautions such as hand washing and good hygienic practice among the users of mobile phones is advocated, to prevent the possibility of phones as

vehicles of transmission of both hospital and community-acquired bacterial diseases.

Researchers conducted a pilot study to estimate the prevalence and type of microorganisms isolated from the mobile phones of 80 healthcare workers at a Thai hospital before and after alcohol cleansing. The surface of the phone's keypad, mouthpiece and earpiece was swabbed and the phone was cleaned with a 70 percent alcohol pad. A second culture swab of the keypad, mouthpiece and earpiece was obtained 1 minute later. The researchers reported that 38 participants (47.5 percent) had exposure to multidrug-resistant bacteria at enrollment in the study, and there was an average of two cases per house staff with multidrug-resistant bacteria. 3 mobile phones (3.8 percent) had cultures positive for *Acinetobacter* spp. before alcohol cleaning. After alcohol cleansing, no microorganisms were detected. Overall hand hygiene compliance was 39 percent before touching a patient, 29.4 percent before a clean/aseptic procedure, and 47.5 percent after touching a patient's surrounding. Although previous reports identified healthcare workers' mobile phones as a reservoir for various multidrug-resistant bacteria, none had shown that alcohol cleansing can reduce the detection of bacteria on mobile phones.¹⁷

CONCLUSION

Health professionals from microbiologists, epidemiologists, doctors, dentists, to behavioral scientist and occupational safety consultants need to take note of how and where we are using our cell phones, draft new guidelines, prevention tips and help raise awareness about the health risks of using an unclean cell phone. However, we recommend that patients and doctors be educated by clear guidelines and advised on inpatient mobile phone etiquette, regular cleaning of phones, hand hygiene, and advised not to share phones or related equipment with other inpatients in order to prevent transmission of bacteria. Cell phones are now an extension of a person's lifestyle, accompanying them everywhere. Everyone should clean their cell phones, but especially doctors, dentists and nurses whose hygiene impacts the patients well-being.

REFERENCES

- Kapdi M, Hoskote S, Joshi SR (2008). Health hazards of mobile phones: an Indian perspective. *JAPI*; 56:893-97.
- Neubauer G, Röösl M, Feychting M, Hamnerius Y, Kheifets L, Kuster N, Ruiz I, Schüz J, Überbacher R, Wiart J (2005). Study on the Feasibility of Epidemiological. Studies on Health Effects of Mobile Telephone Base Stations – Final Report: A workshop Organized by Swiss Research Foundation on Mobile Communication Swiss Agency for the Environment, Forests and Landscape Swiss Federal Office of Public Health FSM – Project No. A2003-9.

- Washington (2011). Study finds dangerous bacteria on cell phones of hospital based patients. Available from: <http://www.elsevier.com/wps>
- Brady RR, Wasson A, Stirling I, McAllister C, Damani NN (2006). Is your phone bugged? The incidence of bacteria known to cause nosocomial infection in healthcare workers mobile phones. *J. Hosp Infect* 62: 123-125
- Srikanth P, Rajaram E, Sudharsanam S, Lakshmanan A, Mariappan U, Jagannathan K (2010). Mobile phones: emerging threat for infection control. *J. Infect. Prev.* vol. 11 no. 3 87-90.
- Karabay O, Kocoglu E, Tahtaci M (2007). The role of mobile phone in the spread of bacteria associated with nosocomial infections. *J. Infect. Develop. Countries.* 1: 72-73.
- Goldblatt JG, Krief I, Haller TD, Milloul V, Sixsmith DM, Srugo I, Potasman I (2007) Use of Cellular Telephones and Transmission of Pathogens by Medical Staff in New York and Israel. *Infect Control Hosp Epidemiol* 28: 500-503.
- Brady RR, Hunt AC, Visvanathan A, Rodrigues MA, Graham C, Rae C, Kalima P, Paterson HM, Gibb AP (June 2011). Mobile phone technology and hospitalized patients: a cross-sectional surveillance study of bacterial colonization, and patient opinions and behaviours. *Clinical Microbiology and Infection.* Volume 17, Issue 6, pages 830–835.
- Tekerekoğlu MS, Duman Y, Serindağ A, Cuğlan SS, Kaysadu H, Tunc E, Yakupogullari Y (2011). Do mobile phones of patients, companions and visitors carry multidrug-resistant hospital pathogens? *Am. J. Infect. Control.* ; 39(5):379-81.
- Bures S, Fishbain JT, Uyehara CF, Parker JM, Berg BW (2000). Computer keyboards and faucet handles as reservoirs of nosocomial pathogens in the intensive care unit. *Am. J. Infect. Control* 28: 465-471.
- Ramesh J, Carter AO, Campbell MH, Gibbons N, Powlett C, Moseley H SR, Levis D, Carter T (2008). Use of mobile phones by medical staff at Queen Elizabeth Hospital Barbados: evidence for both benefit and harm. *J. Hospt. Infect.* 70: 160-165.
- Ulger F, Essen S, Dilek A, Yanik K, Gunaydin M, Leblebicioglu H (2009). Are we aware how contaminated our mobile phones are with nosocomial pathogens? *Ann Clin Microbial Antimicrob* 8: 7.
- Semmelweis IP: *Die Aetilogie, der Begriff und die Prophylaxis des Kindbettfiebers.* Budapest: C.A. Hartleben's Verlags-Expedition; 1861.
- Rusin P, Maxwell S, Gerba C (2002). Comparative surface-to-hand fingertip to-mouth transfer efficiency of gram-positive bacteria, gram negative bacteria and phage. *J Appl. Microbiol.* 93: 585-592.
- Fatma Ulger, Saban Esen, Ahmet Dilek, Kerametin Yanik, Murat Gunaydin, Hakan Leblebicioglu (2009). Are we aware how contaminated our mobile phones with nosocomial pathogens? *Annals Clin. Microbiol. Antimicrobials.*, 8:7
- Singh S, Acharya S, Bhat M, Rao SK, Pentapati KC (2010). Mobile phone hygiene: potential risks posed by use in the clinics of an Indian dental school. *J. Dent. Educ.*; 74(10):1153-8.
- Sumritivanicha A, Chintanavilas K, Apisarnthanarak A (2011). Prevalence and Type of Microorganisms Isolated from House Staff's Mobile Phones before and after Alcohol Cleaning. *Infection Control and Hospital Epidemiology.* Vol. 32, No. 6.