

Original Research Article

Microbial contamination of mobile phones in a tertiary care hospital

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ABSTRACT

Background: Mobile phones could act as a reservoir of infection which may facilitate patient to patient transmission of microorganisms in hospital settings. Objectives of the study were to screen the mobile phones of health-care workers versus non health care workers for microbial contamination with special reference to methicillin-resistant *Staphylococcus aureus* (MRSA) and extended-spectrum beta lactamases (ESBL).

Methods: This is a cross-sectional prospective study conducted in a tertiary care hospital among 110 swab samples collected from the mobile phones of health care workers versus non health care workers. The study duration was 3 months.

Results: 87.3% and 56.4% of the mobile phones of health care workers versus non health care workers yielded growth. Two and more than two types of growth were predominant among both health care workers (56.4%) versus non health care workers (29.1%). Coagulase negative *Staphylococcus* was predominant followed by aerobic spore bearers and micrococci in the study group.

Conclusions: Health-care personnel should practice increased adherence to infection control precautions such as hand hygiene.

Keywords: Healthcare workers, Nosocomial pathogens, Mobile phones

INTRODUCTION

The use of electronic gadgets like mobile phones have become a part of life, They are being used in almost all places irrespective of hospital halls, laboratories, outpatient department, operation theatres, and various areas in the hospital. These mobile phones could probably act as fomites and may facilitate transfer of microbes from one patient to another in hospital settings. They are seldom cleaned and are often touched during or after examination of patients and handling of specimens without proper hand washing.¹

These mobile phones are now described as “technological petri dishes” where in they might play a role in hospital acquired infections as they spread through the hands of health-care personnel.² The problem with these gadgets are when compared to stationary fomites they facilitate inter-ward (and possibly inter-facility) transmission and pathogens on them are very difficult to eliminate by surface cleaners and other disinfectants used routinely in hospitals.^{3,4} The use of mobile phones should be weighed against the risk of contamination and transmission of infections in hospitals and other health associated units. It is of utmost importance that the role of electronic gadgets like mobile phones in spreading infections are identified

at an earlier stage so that preventive measures can be taken.⁵

The study was conducted with the aim to screen the mobile phones of health-care personnel for various bacteria and fungi with special reference to methicillin-resistant *Staphylococcus aureus* (MRSA) and extended-spectrum beta lactamases (ESBL).

METHODS

Setting of the study and study design

This study was conducted in a tertiary care hospital among 110 swab samples collected from the mobile phones of health care workers. The study duration was 3 months (June to August 2017). This is a cross-sectional prospective study.

Procurement of permission

Institutional ethical committee approval was obtained prior to the study. Purpose of the study was explained to each health care worker and consent was obtained.

Methodology

Collection of sample and processing

Sterile swab sticks (Sterilin, UK) were made wet slightly with physiological saline and rubbed over the entire surface of the mobile phone. The swab samples were then sent immediately to the microbiology laboratory for culture and sensitivity.

Microbiological analysis

The samples were then inoculated on nutrient agar, blood agar and MacConkey's agar plates and incubated

aerobically at 37° C temperature for 24 hours. Growth was processed according to standard microbiological techniques which includes Gram staining, colony characteristics and biochemical properties.

Antimicrobial sensitivity testing

Criteria for antimicrobial sensitivity testing was carried out as per Clinical Laboratory standard institute (CLSI).⁹ Antimicrobial sensitivity testing was done on Muller Hinton Agar (MHA) by Kirby Bauer's disc diffusion method. Methicillin resistance in *Staphylococcus aureus* (MRSA) was tested using Muller Hinton Agar with Cefoxitin disc (30 mcg) by Kirby-Bauer disc diffusion methods as per CLSI guidelines.

Suspected extended- spectrum beta lactamases (ESBLs) producing *Enterobacteriaceae* was confirmed by double disk synergy test as per CLSI guidelines.⁶ *Staphylococcus aureus* (ATCC 25923), *E. coli* (ATCC 25922) and *P. aeruginosa* (ATCC 27853) was used as quality control throughout the study for culture and antimicrobial susceptibility testing.

Statistical tool

The data's are entered onto an Excel sheet and then analysed. Simple descriptive statistics expressed in percentage and Chi-square test are used as statistical tools in this article.

RESULTS

Table 1 depicts the percentage of microbe growth from mobile phones of health workers when compared to non-health care workers. Of the 55 health care workers, 48 (87.3%) of them yielded growth of some microbes when compared to non-health care workers where 31(56.4%) only yielded growth.

Table 1: Percentage of growth from mobile phones of health care workers and non health care workers.

	Growth obtained N (%)	No growth N (%)	
Health care worker (n=55)	48 (87.3)	7 (12.7)	Fisher's extract test statistic value is 0.0003; p<0.05
Non health care worker (n=55)	31 (56.4)	24 (43.6)	

Table 2: Number of mobile phones showing single or mixed microbial flora.

	Health care worker (n=55) N (%)	Non health care worker (n=55) N (%)
No growth	7 (12.7)	24 (43.6)
Single type of growth	17 (30.9)	15 (27.3)
Two types of growth	19 (34.6)	12 (21.8)
More than two types of growth	12 (21.8)	4 (7.3)

Table 2 compares the micro-organism growth pattern in a health care worker when compared to non health care worker. The mobile phones of HCW showed 30.9%,

34.6%. 21.8% vs. non HCW showed 27.3%, 21.8%, 7.3% growth of single/two/more than types growth respectively.

From the below Table 3, the predominant organism being coagulase negative *Staphylococci*, aerobic spore bearers, and *Micrococci* among HCW and non HCW's. The other organisms being MRSA, MSSA, non-fermenters, ESBL strain of *E. coli*, which is similar to organisms present in hospital acquired infections.

Table 3: Isolated organisms from mobile phones of health care worker vs. non health care worker.

Organism isolated	Health care worker	Non health care worker
	N (%)	N (%)
Coagulase negative <i>Staphylococci</i> (CONS)	14 (28.6)	11 (35.4)
Aerobic spore bearers	11 (22.4)	8 (25.8)
<i>Micrococci</i>	12 (24.5)	7 (22.6)
Methicillin resistant <i>S. aureus</i> (MRSA)	1 (2.1)	2 (6.5)
Methicillin sensitive <i>S. aureus</i> (MSSA)	4 (8.2)	1 (3.2)
Non fermenters	4 (8.2)	2 (6.5)
<i>E. coli</i> (ESBL)	3 (6.1)	-
Total	49 (100)	31 (100)

DISCUSSION

The hospital environment plays a critical role in the transmission of micro-organisms associated with hospital acquired infections. The health care workers mobile phones can provide a reservoir of bacteria known to cause nosocomial infections.

In this study, mobile phones used by HCWs in various departments in the hospital, including the operating rooms and intensive care units (ICU), showed high contamination with bacterial pathogens.

In this study 87.3% mobile phones of health care workers and 56.4 % mobile phones of non health care showed growth. A study done by Arora et al, Uglar et al, Tambe et al showed 91.6%, 94.5%, 90.98% of phones demonstrated evidence of bacterial contamination with different type of bacteria.^{1,7,8}

In the present study, it was reported that the majority of health personnel showed polymicrobial growth, i.e., 30.9% were monomicrobial, 34.6% showed growth of two bacteria and 21.8% had growth of three or more bacteria on their mobile phones which is in accordance with the study done by Chawla et al which stated 40% mobile phones with two types of organisms, 27.5% showed the presence of three or more types of organisms and 25% were monomicrobial.⁹

The most common organism in both health care workers and non health care workers is coagulase negative *Staphylococcus* and aerobic spore bearers which is in

accordance with the study done by Bhumbra et al, Ulger et al, Karabay and Kocoglu and Killiac et al.^{7,10-12}

This bacterium is responsible for a large number of hospital acquired infections and is often difficult to treat because of its genetic characteristics and growing resistance to high-powered antibiotics.¹³ It resists drying and can multiply rapidly in warm environments such as mobile phones.¹⁴

MRSA and *Escherchia coli* (ESBL producer) was isolated from 6.1%, and 6.1% respectively which is very much lesser than the previous studies Badr et al where 31% cases were MRSA and Pal et al where 21.05% were MRSA.^{15,16}

The use of mobile phones is extremely important in the healthcare delivery system and it may not be practicable to stop its use. Restricted use of mobile phones during working hours along with proper hand hygiene practices will enable mobile phones to remain free of contamination. Some researchers have suggested that the best way to handle this problem is ultrasonic cleaning by an ultrasonic cleaner which cleans the mobile phones thoroughly and safely.¹⁷ However, one study reported the use of 70% isopropyl alcohol as an effective disinfectant or antimicrobial additive materials which may be effective in reducing the risk of cross contamination.^{18,19}

In conclusion, we suggest that health-care personnel should practice increased adherence to infection control precautions such as hand hygiene. Hand washing after or before attending a call is to be recommended strictly. The development of effective preventive strategies for well-practiced infection control plan is an essential need to encompass environmental decontamination, hand hygiene, surveillance, and contact isolation for prevention of such nosocomial infections.

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REFERENCES

1. Arora U, Devi P, Chadha A, Malhotra S. Cell phones a modern stay house for bacterial pathogens. *J K Sci*. 2009;11(3):127-9.
2. Tambe NN, Pai C. A study of microbial flora and MRSA harbored by mobile phones of health personnel. *Int J Rec Trends Sci Technol*. 2012;4(1):14-8.
3. Bures S, Fishbain JT, Uyehara CF, Parker JM, Berg BW. Computer keyboards and faucet handles as reservoirs of nosocomial pathogens in the intensive care unit. *Am J Infect Control*. 2000;28:465-71.
4. Ekkrakene T, Igeleke CL. Micro-organisms associated with public mobile phones along Benin-

- sapele Express Way, Benin City, Edo State of Nigeria. *J Appl Sci Res*. 2007;3(12):2009–12.
5. Elkholy MT, Ewees IE. Mobile (cellular) phone contamination with nosocomial pathogens in intensive care units. *Med J Cairo Unit*. 2010;2:1-5.
 6. Clinical and Laboratory Standards Institute (CLSI). Performance Standards for Antimicrobial Susceptibility. 2017. Available at: http://ncipd.org/control/images/NCIPD_docs/CLSI_M100-S24.pdf. Accessed 12 November 2017.
 7. Ulger F, Esen S, Dilek A, Yanik K, Gunaydin M, Leblebicioglu H. Are we aware how contaminated our mobile phones with nosocomial pathogens? *Ann Clin Microbiol Aantimicrob*. 2009;8(1):7.
 8. Tambe NN, Pai C. A study of microbial flora and MRSA harboured by mobile phones of health care personnel. *Int J Rec Tre Sci Tech*. 2012;4:14-8.
 9. Chawla K, Mukhopadhyay C, Gurung B, Bhate P, Bairy I. Bacterial “cell” phones: Do cell phones carry potential pathogens? *Online J Health Allied Sci*. 2009;8(1):8-10.
 10. Bhumbla U, Ahmad SM, Mathur DR, Bandey L, Mathur G. Study on microbial contamination of mobile phones and their role in nosocomial infections in a tertiary hospital of south India. *Asian J Pharm Clin Res*. 2016;9(3):201-2.
 11. Karabay O, Kocoglu E. The role of mobile phones in the spread of bacteria associated with nosocomial infections. *J Infect Dev Ctries*. 2007;1(1):72-3.
 12. Killiac IH, Ozaslan M, Karagoz ID, Zer Y, Davatoglu V. The microbial contamination of mobile phones used by the healthcare staff. *Pak J Biol Sci*. 2009;12:882-4.
 13. Lamb EJ. *Staphylococcus epidermidis* characteristics. eHow contributor; accessed on Dec. 2010. Available at: http://www.ehow.com/about_5459843_staphylococcusepidermidis-characteristics.html. Accessed on 12 November 2017.
 14. Trivedi HR, Desai KJ, Trivedi LP, Malek SS, Javdekar TB. Role of mobile phone in spreading hospital acquired infection: a study in different group of health care workers. *NJIRM*. 2011;2(3):61–6.
 15. Badr RI, Badr HI, Nabil MA. Mobile phones and nosocomial infections. *Int J Infect Control*. 2012;8(2):1-5.
 16. Pal K, Chatterjee M, Sen P, Adhya S. Cell phones of health care professionals: A silent source of bacteria. *Natl J Lab Med*. 2015;4(4):33-8.
 17. The best way to clean your cell phone-ultrasonic cleaning. Available at: <http://www.articlesbase.com/health-articles/the-best-way-to-clean-yourcell-phone-ultrasonic-cleaning-1082298.html>. Accessed 12 November 2017.
 18. Jayalakshmi J, Appalaraju B, Usha S. Cellphones as reservoirs of nosocomial pathogens. *J Assoc Phys India*. 2008;56:388–9.
 19. Neely AN, Sittig DF. Basic microbiologic and infection control information to reduce the potential transmission of pathogens to patients via computer hardware. *J Am Med Inform Assoc*. 2002;9:500–8.

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