

Bacteriological Study of Flora Harboured by Mobile Phones of Health Care Personnel at Tertiary Care Hospital, Aurangabad

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ABSTRACT

Background: Despite advancements in contemporary detection and treatment, hospital-acquired infections remain a major issue for international health systems. Potential infections can be found on healthcare personnel's mobile phones. Despite the considerable risk of contamination, cell phones are rarely sanitized and are frequently handled without properly washing hands before or after patient examinations and specimen processing. This study aimed to separate, characterize, and quantify the various kinds of bacteria and their susceptibility to antibiotics from the mobile phones of both healthcare and non-healthcare personnel.

Methods: Samples were taken aseptically by rolling over the exposed surfaces of the inoculated mobile phones on the agar plates, which were subsequently incubated aerobically. After incubation, the plates were examined for growth. Following accepted microbiological practices, bacteria were discovered and antibiotic sensitivity was assessed.

Results: Out of 50 mobile swabs of each category, 58% of samples were culture-positive in healthcare workers (HCW) and 20% in non-healthcare workers. The most common pathogen isolated was *Staphylococcus aureus* i.e. 23(46%). Out of 23, (5) were MRSA and (18) were MSSA. MRSA isolation, in doctors 2(7.6%), 2(12.5%) in nurses and 1(12.5%) in ward boy. According to our research, healthcare workers' mobile phones have unquestionably been colonized by microorganisms. It can transmit not just messages but also microorganisms that cause illness.

Conclusion: Therefore, the study highlights the necessity of reducing the spread of infection via cell phone use by adhering to stringent hand hygiene guidelines and refraining from using cell phones when providing patient care or performing therapeutic operations. Using additional disinfectants or 70% isopropyl alcohol, disinfect it.

Key-words: Health care workers (HCW), Mobile phone, Methicillin-resistant *Staphylococcus aureus* (MRSA), Methicillin-susceptible *Staphylococcus aureus* (MSSA), Tertiary Care hospital

INTRODUCTION

Healthcare facilities face a significant challenge from healthcare-associated infections (HAIs), which can have

a significant impact on mortality, morbidity, and financial costs.^[1] The delivery of healthcare involves the usage of mobile phones in every facet. These are the most popular and favored means of communication. The bacterial contamination of cell phones is one topic that has not been discussed. Due to their close contact with the mouth, nose, ears, hands, and different clinical situations, they are especially vulnerable to this. Because of the warmth and perfect temperature, putting cell phones in pockets, purses, and tight pouches increases

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the chance of bacterial growth. People use their mobile phones nonstop all day but never clean.^[2]

Healthcare-associated infections (HAIs) can potentially compromise patient safety and increase costs. Mobile phones have become essential communication tools in the healthcare sector and have enhanced patient care. 47.4% of medical staff reported using their phones more than five times while working in the intensive care unit (ICU). It has been demonstrated that healthcare workers' cell phones serve as reservoirs for nosocomial infections. Hand contact between departments can facilitate the spread of pathogenic bacteria, which can be readily attached to the surfaces of mobile phones and transfer from the healthcare worker's phone to the patient's. These changes have caused researchers to be concerned about the precise mechanism by which healthcare-associated infections (HAIs) are disseminated by contaminated mobile phones. Critical care, operating rooms, intensive care units, and burn units are among the hospital departments most vulnerable to HAIs, because of the compromised health of patients and the intrusive nature of medical equipment.^[1] HCWs utilize mobile phones for more than just communication in contemporary healthcare environments. Nevertheless, mobile devices could expedite access to apps and diagnostic and therapeutic information, enhancing clinical decision-making, patient care, and HCWs' overall workflow performance within any health system.^[1]

Due to their frequent contact with the mouth, nose, ears, hands, and various clinical surroundings, and they are rarely cleaned, mobile phones can contaminate different germs.^[2]

Mobile phone use has become essential in hospitals due to recent advancements in information sources. These can be set to vibratory mode in ICUs, post-operative wards, operating rooms, and other settings. Nevertheless, they are rarely cleaned, frequently touched during or after patient examinations, and specimens are handled without using the appropriate handwashing techniques.^[3]

MATERIALS AND METHODS

Place of study- The present study has been undertaken to isolate bacteria from HCWs' mobile phones and to study the difference in bacterial flora from non-HCWs' mobile phones at tertiary care hospital i.e. MGM Medical College and Hospital, Aurangabad.

Study Period- January 2011 to June 2011.

Inclusion Criteria- Mobile phone swabs were collected from HCWs and non-HCWs from various wards.

Exclusion Criteria –Other than swab samples were not taken.

Using standard microbiological procedures, identification was completed (Gram stain, motility, biochemical testing).

Methodology

Sample Collection- Samples were taken aseptically by rolling over the exposed surfaces of the mobile phones and using sterile swabs saturated with sterile normal saline. Because the phones' sides, back, mouthpiece, earpiece, keypad, and screen are the most often touched places, great care was taken to ensure they were all thoroughly swabbed.

Sample Inoculation- After collection, the samples were immediately sent to the lab where they were inoculated on 5% sheep blood agar and Mac-Conkey's agar plates. The plates were then aerobically incubated for 24 hours at 37°C. Following incubation, the isolates' colonial shape and growth were assessed on the plates. Bacteria classified as Gram-positive or Gram-negative were detected using standard microbiological techniques. Out of these 26 mobile swabs were from doctors, 16 from nurses and 8 from ward boys. Similarly, 50 mobile phone swabs were collected randomly from the staff of Engineering College.

Statistical Analysis- This study indicates that the contamination of mobile phones of HCWs is significantly higher ($p=0.000$) than that of non-HCWs.

Ethical approval- It is an observational study. No animal or human samples are being used.

RESULTS

Growth is seen in cell phone users of health care and non-healthcare workers. The maximum growth is seen in healthcare workers (58%) compared to non-healthcare workers (Table 1).

Table 1: Culture results of cell phones of HCWs and non-HCWs

Category	Total swabs of mobile phones	Culture Positive (%)	Culture Negative (%)
HCWs	50	29(58)	21(41)
Non-HCWs	50	10(20)	40(80)

Different types of bacterial growth are seen in mobile phone users' HCWs and non-HCWs. Among Health care workers, *S. aureus* is predominantly seen (41.3%)

compared to other isolates. Among non- Health Care Workers CONS is predominantly seen (Table 2).

Table 2: Bacterial agents isolated in HCWS and non-HCWS mobile phones.

Health Care Workers										
Category of HCW	No. of swab collected	Culture positive (%)	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)	8 (%)
doctors	26	15 (57.6)	12 (41.3)	1 (3.4)	1 (3.4)	1 (3.4)	0	0	0	11 (52.3)
Nurse	16	9 (56.25)	7 (24.1)	1 (3.4)	0	1 (3.4)	0	0	0	7 (33.3)
Ward boys	8	5 (62.5)	4 (13.7)	0	0	0	1 (3.4)	0	0	3 (14.2)
Staff of Eng. college	50	10	2 (20)	5(50)	0	0	0	1(10)	2(20)	40
Total	50	10	2	5	0	0	0	1	2	40

1= *S. aureus*; 2= CONS; 3= *E. coli*; 4= *Klebsiella*; 5=*Pseudomonas*; 6=*Proteus*; 7= *Bacillus sp.*; 8= Culture sterile

Table 3 describes the Distribution of MRSA and MSSA on mobile phones of HCWs among doctors, nurses and ward boys. Maximum MRSA is seen in Nurses and Ward boys

(12.5%) as compared to doctors. Meanwhile, MSSA is the maximum seen in doctors (38.4%) compared to nurses and ward boys.

Table 3: Distribution of MRSA and MSSA on mobile phones of HCWs.

Category of HCWs	<i>Staph aureus</i>	MRSA (%)	MSSA (%)
Doctors (n=26)	12	2 (7.6)	10 (38.4)
Nurses (n=16)	7	2 (12.5)	5 (31.2)
Wardboy (n=8)	4	1 (12.5)	3 (37.5)
Total (n=50)	23(46)	5 (10)	18 (36)

Table 4 describes the distribution of MRSA and MSSA on mobile phones of non- HCWs workers. MSSA is more as compared to MRSA.

Table 4: Distribution of MRSA and MSSA on mobile phones of non-HCWs

Category of non-HCWs	<i>Staph aureus</i> (%)	MRSA	MSSA (%)
Staff of Eng. college (n=50)	2 (4)	Nil	2 (4)

Table 5 shows the difference between HCWs and non-HCWs from 100 samples. 39 where positive and tests were statistically significant ($p=0.000$) and more culture positivity was seen in HCWs.

Table 5: Association between type of workers and bacterial cultures

Category of workers	Culture			χ^2 -value	p-value
	Positive	Negative	Total		
HCWs	29	21	50	15.2	p=0.000 Significant
Non –HCWs	10	40	50		
Total	39	61	100		

DISCUSSION

Hospital-acquired infection caused by multidrug-resistant organisms is a growing problem in many healthcare institutions.^[4-6] Hands, instruments, mobile phones or other inanimate hospital objects used by HCWs may serve as vectors for the nosocomial transmission of microorganisms.^[7,8-10]

In the present study, 58% of mobile phones of HCWs showed bacterial growth. In the present study, non-healthcare workers comprised of a staff of an engineering college showed bacterial growth in 20% of mobile phones in this group. A higher rate of contamination of health care workers' mobile phones was reported by Tambekar *et al.*^[11] in Amravati city i.e. 95%.

Elkholy *et al.*^[12] obtained similar findings at 96.5% and Goel *et al.* at 94.5%^[2]. Chawala *et al.*^[13] reported 77.5% bacterial contamination among healthcare workers' mobile phones. Akinyemi *et al.*^[14] reported the contamination rate, i.e. 15% in healthcare workers. They have given the reasons for the low contamination rate, which is due to the regular disinfection of mobile phones.

A similar result from Usha Arora *et al.*^[3] reported that 90 swabs from non-clinical workers showed 21.25% bacterial growth. Chawala *et al.*^[13] reported higher bacterial contamination among non-healthcare workers at 37(92.5%).

In this study, 57.6% of doctors' and 56.2% of nurses' phones showed bacterial contamination. Similar findings shown by Jaya *et al.*^[15] reported 52% bacterial contamination in doctors and a lower rate of bacterial contamination in nurses i.e. 33%. Trivedi *et al.*^[16] reported higher bacterial contamination in nurses i.e. 50%, than in doctors i.e. 38%. Doctors and nurses have close regular contact with patients because they know hygiene and always keep their mobiles in pouches. Due to their busy schedules, these members often do not wash their hands before answering their phones.

In our study, the rate of contamination of mobile phones in the ward boy group was higher i.e. 62.5% than in other groups (doctors and nurses). Our results are from Trivedi *et al.*^[16], who reported 52% bacterial contamination. They have stated that this may be due to a lack of awareness of cleaning of mobiles.^[16] Jaya *et al.*^[15] reported 39.7% mobile contamination in the attendants group.

Our study revealed that 2% of each gram-negative bacteria (*E. coli*, *Klebsiella*, and *Pseudomonas*) were isolated in healthcare workers' mobile phones. Similarly low number of isolates was also found by Srikanth i.e. 2% each of *E. coli*, *Klebsiella*, *Pseudomonas*, and *Acinetobacter* sp. 6(7%).^[17] Trivedi *et al.*^[16] have shown that *P. aeruginosa* and *Acinetobacter* species were isolated and showed multi-drug resistance to commonly used antibiotics. Their ability to contaminate mobile phones is expected as they are multidrug-resistant water and soil organisms and are responsible for infection in hospital immunocompromised patients.

In this study, 10% *MRSA* was isolated from mobile phones of HCWs i.e. doctors (7.6%), nurses (12.5%), and ward boys (12.5%). Our findings are lower than those of other studies. Datta *et al.*^[18] reported 18% *MRSA* isolation. A very high rate i.e. 83% *MRSA* was isolated in HCWs mobile phones by Tambekar *et al.*^[11]. Arora *et al.*^[3] reported *MRSA*, *E. coli* and *Acinetobacter* (multi-drug resistant) isolated from phones of healthcare personnel performing surgeries or attending acutely ill patients in ICU. They said that they could transfer these germs to patients.

In our study, the reported *coagulase-negative staph* was 4%. Many studies have found a higher finding of *Coagulase negative staph* i.e. Akinyemi *et al.*^[14] reported 50.1% as the most prevalent bacterial agent from mobile phones in group D (hospital workers).

Arora *et al.*^[3] reported that *coagulase-negative staph* was the most common organism isolated from mobile phones of clinical(n=70) and non-clinical(n=90) workers i.e.15 and 12. This is well-known that organisms like *S.*

aureus and *Coagulase negative staph* resist drying and thus can survive and multiply rapidly in warm environments like cell phones. They have shown the efficacy of decontamination with 70% isopropyl alcohol was 98%. This study indicates that the contamination of mobile phones of HCWs is significantly higher ($p=0.000$) than that of non-HCWs.

When a sizable portion of HCWs do not wash their hands before and after seeing a patient or clean their cell phones after using them in a hospital setting, Chawala *et al.* ^[13] said that the results of the questionnaire are concerning and demonstrate that HCWs are seriously lacking in awareness of safety precautions. The studies showed that 97.5% use cell phones in hospitals while attending to patients, and 65% use phones when involved with invasive procedures. 52.5% do not clean their phones regularly and 87.5% do not wash their hands after using cell phones. 32.5% do not believe that cell phones can act as vectors for nosocomial infection. ^[13] Gunasekara *et al.* ^[19] concluded that it is important to encourage higher compliance with hand wash practice and routine surface disinfections of personnel use items brought to OTs.

Due to resource constraints, it was not possible in the present study to prove directly whether the isolates from mobile phones or HCWs were responsible for nosocomial infection. However, as numerous studies have shown, these mobile cells are home to various potentially dangerous bacteria that could resist drugs, act as an exogenous source of nosocomial infections in hospitalized patients, and endanger the patient's and their family's health.

CONCLUSIONS

Of 50 mobile swabs of each category, 29(58%) samples were culture-positive in healthcare workers and 10(20%) in non-healthcare workers. Out of 29 positive cultures in health care workers, 23(46%) *Staph aureus*, 2(4%) *CONS*, and 1(2%) each of *E. coli*, *Klebsiella*, and *P. aeruginosa* was isolated. The most common pathogen isolated was *Staph aureus* i.e. 23(46%). Out of 23, (5) were *MRSA* and (18) were *MSSA*. *MRSA* isolation in doctors is 2(7.6%), 2 (12.5%) in nurses, and 1(12.5%) in inward boys. Non-health care workers out of these 5(10%) *CONS*, 2(4%) *Staph aureus*, 2(4%) *Bacillus* sp. and 1(2%) *Proteus* was isolate. No *MRSA* was isolated. It is concluded that compared to non-HCWs, the bacterial carriage rate of

HCW cell phones was higher. Also, the organism isolated from the HCWs phone has a higher potential for causing nosocomial infections.

Thus, the study emphasizes the need to reduce the transmission of infection through mobile phones by following strict hand hygiene measures and avoiding answering mobile phones during patient care and therapeutic procedures.

CONTRIBUTION OF AUTHORS

Research concept- Jyotsna Mishra

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Materials- Sharda Shinde

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Critical review- Jyotsna Mishra

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