

Original Research Article

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## Microbial Contamination of Mobile Phones a Potential Threat to the Patients: A Cross Sectional Study

Shazia Naaz, K. Madhavi\*, Kiran Mai and Rajive K. Sureka

Department of Microbiology, MediCiti Institute of Medical Science, Hyderabad,  
Telangana, India

\*Corresponding author

### ABSTRACT

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Mobile communication devices help accelerate the hospital flow of medical information but can serve as a "foe" for the patients when they act as a potential vector for transmitting nosocomial infections. This study aimed to describe the role of the cell phones in transmitting bacteria to dominant hands of the HCW's in the various ICU's as MediCiti Institute of Medical Sciences, emphasizing the role of mobiles in the spread of HAI. It was a cross-sectional study including HCW's at various ICU's in our hospital. Samples for culture and sensitivity were collected from the dominant hand and the mobile phones of each study participant and were processed according to standard guidelines. Questionnaire about mobile phone usage, hand hygiene and disinfection practices were administered and assessed. 30% of the study participants never cleaned their mobile phones. The most common bacterial isolate from the hands were *Staphylococcus aureus* (44%) and coagulase negative *Staphylococcus* (CONS - 36%), while from cell phone swabs were similarly *S. aureus* (43%) and CONS (36%). The MRSA isolates from hands and cell phone were 33% and 17% respectively. Gram- negative bacteria were isolated from 15% of the hand swabs and 7% of the mobile swabs respectively. On sensitivity testing, 34% and 25% of these GNB from hand and mobile were ESBL producers. Simple measures like hand washing, cleaning of mobile phones with 70% isopropyl alcohol and a well-practiced infection control plan to bring down the rate of hospital acquired infections are recommended.

### Introduction

Health care associated infections (HCAI) are amongst the most common avoidable complications of healthcare – leading to increased morbidity and mortality.

WHO states “At any given point of time the prevalence of HCAI ranges between 5.7% - 19.1% in low – middle income countries”

(Health care-associated infection FACT SHEET-WHO).

India presents an unnerving incidence rate ranging from 4.4 – 83% pertaining to various HCAI's (Ramasubramanian *et al.*, 2014). As early as 1861 Semmelweis demonstrated that bacteria were transmitted to the patients by contaminated hands of HCW's (Ulger *et al.*, 2009).

Hand hygiene is one of the most important preventive interventions against the spread of infection in the Health Care setting (Heyba *et al.*, 2015). Mobile phones (MP's) are devices that help to accelerate the flow of medical information and contribute to communication in case of emergencies.

Telecom & Regulatory authority of India (TRAI 2018) reported that the number of telephone subscribers in India increased from 115.35 crore at the end of May 2018 to 116.88 crore at the end of June 2018 thereby showing a monthly growth rate of 1.33 per cent.

Mobile phones are used in close contact with the body and as for most non – medical electronic devices, there are no cleaning protocols available in developing countries like India, that meet the hospital standards (Shaktivel *et al.*, 2017).

Places like ICU's require highest hygiene standards. In such critical settings such as ICUs the prolific use of such devices proves to act as a “double edged sword”. It may serve as a “foe” for the patient by acting as a niche for harbouring bacteria to due constant handling and heat generation by device and be responsible for transmitting HCAs.

The present study was aimed to describe the role of mobile phones in transmitting bacteria to the dominant hand and vice versa in various ICU's and to determine their role in the spread of HCAI's at a rural teaching hospital in Medchal district, Telangana.

## **Materials and Methods**

### **Study design**

The present study was a cross sectional study conducted at Medi Citi Institute of Medical Sciences, Medchal, Telangana – September 2018.

### **Sample size**

We screened 50 HCW's posted at that point of time at various ICUs namely PICU, NICU, MICU, SICU. Informed consent was obtained from each participant. Questionnaire about mobile phone usage, hand hygiene, and disinfectant practices was administered and assessed.

### **Inclusion criteria**

All resident doctors, nurses, interns posted in various ICUs at that point of time.

### **Exclusion criteria**

Those HCWs not involved in mobile phone usage in ICUs and the cell phones that have been disinfected recently were excluded.

### **Sample collection**

Two swabs were collected, one from the mobile phones and the other from the dominant hand of the HCW after taking consent. The mobile phone was first held in a sterile gloved hand and samples were collected using sterile swabs moistened with normal saline by rotating and swabbing over the screen, sides, external cover surface of the mobile phones. None of the mobile phones had a separate keypad as all those screened were Smartphone's.

The other swab which was also moistened with normal saline was used to swab the ventral surface of the dominant hand including the finger tips. Samples were properly labelled and sent to the Microbiology department for further processing.

### **Sample processing at the laboratory**

The collected samples upon reaching the microbiology lab were immediately inoculated

onto Blood agar and MacConkey agar. The plates were incubated at 35 – 37 °C for 24hrs and observed for growth. Growth of the bacteria was identified studying the colony morphology, gram stain, and by other standard biochemical reactions. Antibiotic sensitivity testing of isolates was done by Kirby- Bauer disc diffusion methods according to Clinical and Laboratory Standard Institute (CLSI) guidelines.

## Results and Discussion

This study revealed that out of a total of 50 mobile phones and hands screened for microorganisms, 75% and 86% of the mobile and hand swabs respectively showed growth of various pathogenic bacteria.

These findings are similar to other studies where mobile phone and hand contamination rates were reported as follows Chandigarh (Post Graduate Institute Of Medical Education & Research - PGIMER) – 28.57% and 91.7%, Ethiopia – 62% and 78%, Uttarakhand- 81.8% and 80.8%, (Malhotra *et al.*, 2018; Chaka *et al.*, 2016; Pal *et al.*, 2015).

The distribution of major pathogenic isolates from mobile phones and hands of HCW has been presented in Table 1. The commonest isolate identified from both the mobile phones and the hand was *Staphylococcus aureus* (*S.aureus*) – 43% and 44% followed by *Coagulase negative Staphylococcus aureus* (CONS) -36% respectively.

Similar findings were seen in studies conducted at Chandigarh – *S. aureus* and CONS from mobile phones were 31.25% and 25% respectively and *S.aureus* and CONS isolated from hands being 47% and 37.25% respectively- (Malhotra *et al.*, 2018, PGIMER). Study done at Ethiopia reported similar findings with *S. aureus* and CONS from mobile phones being 59% and 37%

respectively and *S. aureus* and CONS isolated from hands being 56% and 20% respectively (Chaka *et al.*, 2016).

On the other hand study done at Uttarakhand, Iran (Bhumbala *et al.*, 2016; Haghbin *et al.*, 2015) found CONS as the most common isolate from both mobile phones and the hands of HCW's. This difference may be due to difference in colonization of individuals in separate geographical areas.

Bacterial contamination of the hand and mobile phones by the same organism was seen in 33 swabs (66%). Study done at Ethiopia and Turkey showed the rates of cross contamination of hands and mobiles were similar by the same organism (Chaka *et al.*, 2016; Ulger *et al.*, 2009) Bhat *et al.*, (2011) also reported similar isolates from mobile phone and hands.

Study done at PGIMER and Turkey (Malhotra *et al.*, 2018; Ulger *et al.*, 2009) reported rate of cross contamination of hands and mobile phones by similar organism was 7.14% and 33.3%. Study done at PGIMER reported a low rate of mobile contamination, and so also lower rates of cross contamination probably due to rules restricting the usage of mobile phones inside the hospital. Similar reasons may be responsible for obtaining lower cross contamination rates in study done at Turkey.

Highest rate of contamination by the same organism on the mobile phones and the hands was amongst interns (100%) followed by residents (65%). These findings have been depicted in Figure 1.

The antibiotic sensitivity pattern revealed that 33% and 17 % of the isolates obtained from hand and mobile phones of the HCW were Methicillin resistant *Staphylococcus aureus* (MRSA). These results have been shown in Figure 2.

These findings are in concordance with other studies showing percentage of MRSA from mobile phones and hand swabs as – Ethiopia – 40% in both mobile phones and hand swabs respectively (Chaka *et al.*, 2016), Turkey – 52% and 37.7% (Ulger *et al.*, 2009).

Rate of mobile contamination with MRSA was high in the study done at Turkey which may be due to lower rates of decontamination of mobile phones and frequent usage in high risk settings in the hospitals.

In the present study, 34% and 25% Gram negative bacilli (GNB) isolated from hand

and mobile phone swabs respectively were ESBL producers, shown in Figure 3.

Similar findings were reported by study done at Peru – 33% ESBLs from mobile phone swabs (Loyola *et al.*, 2017), and study done at Turkey – 39.5 % and 31.3% ESBLs from hand and mobile swabs respectively (Ulger *et al.*, 2009).

On the contrary, EBSL isolated from mobile phones was lower in studies conducted at Uttarakhand – 9.1% and Turkey- 11.2% (Bhumbala *et al.*, 2016; Ustun *et al.*, 2012).

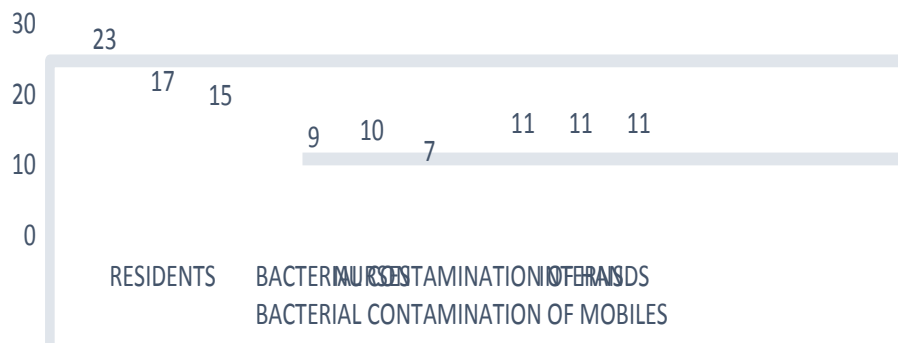
**Table.1** Distribution of major pathogens isolated from hands and mobile phone of HCW’s

Major pathogens isolated	Hands of the HCWs n = 43	Mobiles of HCWs n = 37
<i>Staphylococcus aureus</i>	19 (44%)	16 (43%)
CONS	15 (36%)	13 (36%)
GRAM NEGATIVE BACTERIA	9 (21%)	4 (10%)
OTHERS	-	2 (5.4%)

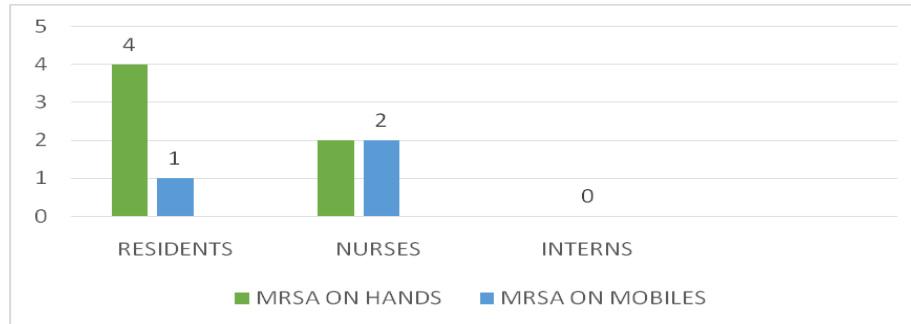
**Table.2** Distribution of usage of Mobile Phones by various HCW’s in the ICU

HCW	Total n= 50	Profession		
		Resident	Nurses	Interns
1. USE OF MOBILE PHONE WHILE WORKING IN ICU	22 (45%)	15	2	5

**Fig.1** Cross contamination of mobile phones and hands by same organism

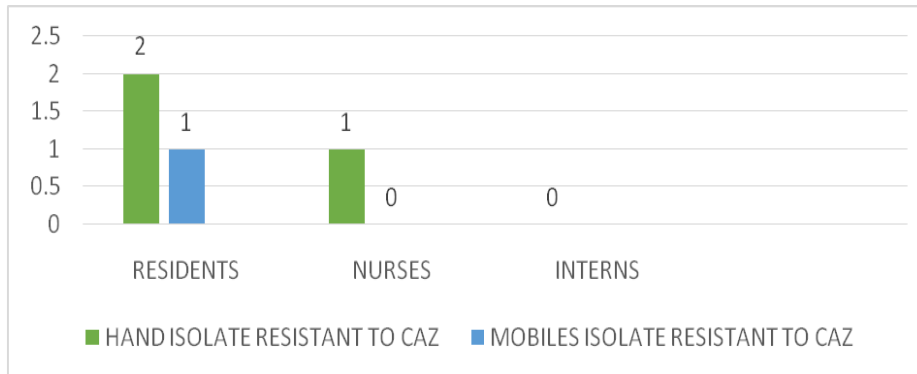


**Fig.2** Distribution of MRSA from hands and Mobile phones of HCWs



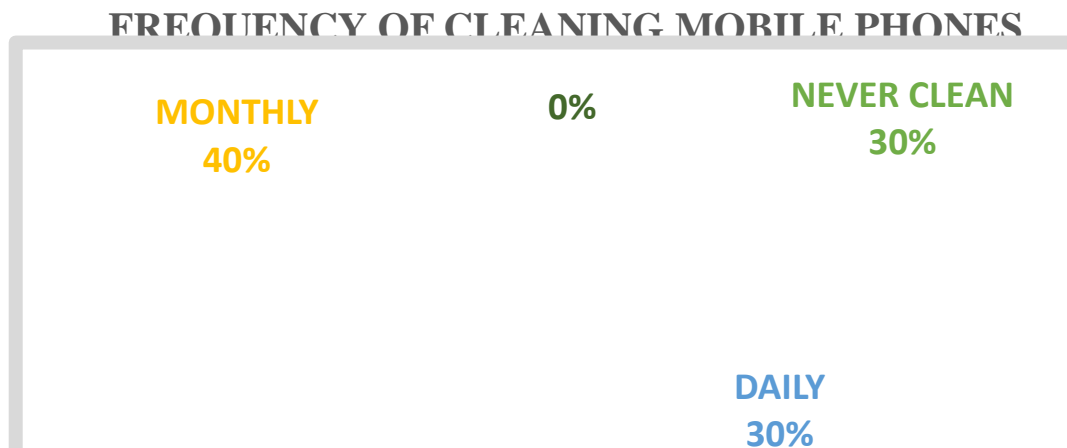
MRSA – HANDS – 6/19 (33 %)  
 MRSA – MOBILES – 3/16 (17%)

**Fig.3** Distribution of ESBL producing gram negative bacteria

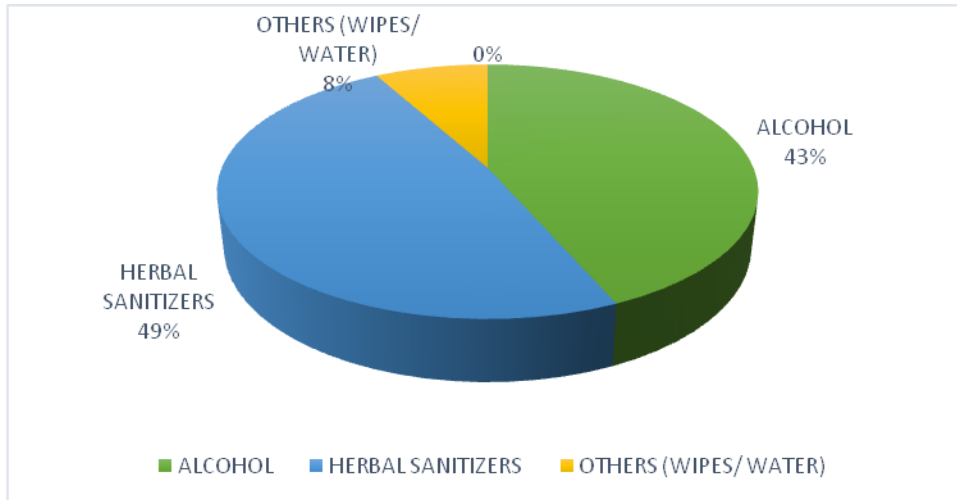


CAZ – Ceftazidime.  
 ESBL producers – hand – 3/9 (34%). ESBL producers – mobiles – 1/ 4 (25%)

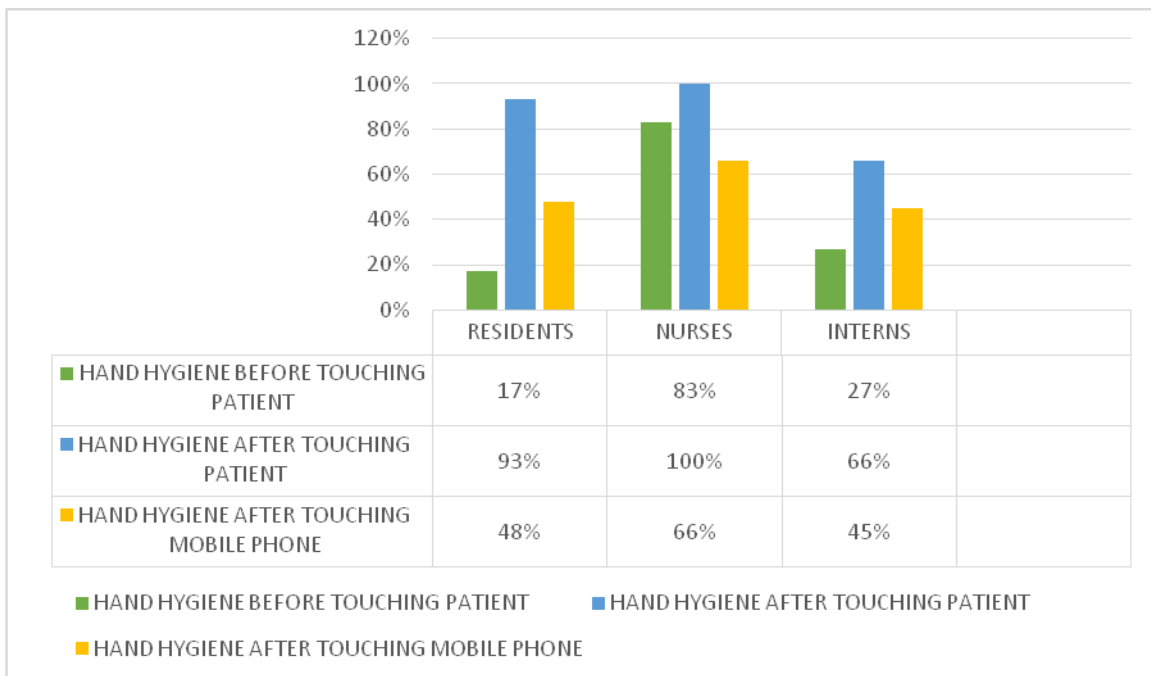
**Fig.4** Frequency of cleaning of Mobile phones by HCW's



**Fig.5** Various Disinfectants used for cleaning the Mobile phones



**Fig.6** Hand hygiene compliance amongst HCW's



The isolation of MRSA and ESBL *Klebsiella pneumoniae* is a matter of concern. It proves the pathogenic potential of the organisms isolated from mobile phones and highlights the risk of mobile phones as vehicles of transmission of serious multiple drug resistant pathogens (Hadir EL-Kady, 2017).

**Questionnaire analysis**

Questionnaire analysis revealed maximum usage of mobile phone in the ICUs was by residents followed by interns use of mobile phone while working in the ICUs by various HCW has been shown in Table 2.

The frequency of cleaning of mobile phones and the usage of disinfectants for cleaning of mobile phones by various HCW's has been depicted in figure 4 and 5. 30% reported never cleaning their mobile phones. 36% reported using alcohol based disinfectant to clean their mobile phones.

Maximum hand hygiene compliance was seen in amongst nurses and least amongst interns. Figure 6 shows compliance to hand hygiene practices amongst the HCW's. Hand hygiene before and after touching the patient were 44% and 90% respectively. Hand hygiene observed after touching the mobile phones was 15%.

Study done at Tamil Nadu reported 100% HCW's were using their mobile phones. 10% were using alcohol based rubs to disinfect their mobile phones. 12% washed their hands after using their mobile phones. 50% HCW's wash their hands before attending the patients (Shakhtivelet *et al.*, 2017).

Study done by Cleveland (Canales M *et al.*, 2017) mentioned usage of alcohol based rubs to clean their mobile phones was 34%. 6% washed their hands after touching their mobile phones.

Their findings were in concordance to the Present study.

On the other hand study done at Saudi Arabia and Ethiopia reported 76% and 85% of their HCW's never cleaned their mobile phones. The usage of alcohol based rubs to clean the mobile phones was quoted as 12.4% and 19% respectively. These rates show the high propensity of contamination which may lead to a predisposition to HCAI's.

Manning *et al* (2013) suggested infection prevention (IP) bundles for mobile phones inclusive of water proof case for mobile

phone, disinfecting mobile phone before and after visiting the patient, setting an alarm on the mobile as reminder for disinfecting it and observing hand hygiene before patient interaction and after disinfecting mobile phone.

To conclude our study reveals Participants hands and mobiles were contaminated with various types of bacteria.

Percentage of similar organisms isolate from mobiles and dominant hand was as high as 66%, implying correlation in the transfer of microorganisms from mobile to hand and vice versa.

Everyday use of mobile phones by HCWs in critical care areas represents an important vehicle- may be capable of causing HCAs. Awareness programmes must be conducted to create cognizance amongst the HCWs of the importance of infection control measures. Strict adherence to hand hygiene practices. Creating a protocol in hospitals to cleanse mobile phones using alcohol based disinfectant/ UV sterilizing unit would help in reducing the burden of HCAs.

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