ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare & Pharmascope Foundation Journal Home Page: https://ijrps.com

# Isolation and identification of bacterial flora associated with mobile phones of health care professionals

Kalyani Mohanram*[1], Shruthilaya Madanagopal[1], Porchelvan Swaminathan[2]

[1]Department of Microbiology, Saveetha Medical College, Thandalam, Kancheepuram Dist. Tamil Nadu, India
[2]Department of Bio-Statistics, Saveetha Medical College, Thandalam, Kancheepuram Dist. Tamil Nadu, India

*Article History:*

Received on: 16.04.2018
Revised on: 12.07.2018
Accepted on: 16.07.2018

*Keywords:*

Mobile phone,
Bacterial flora,
*Staphylococcus aureus,*
Healthcare.

ABSTRACT

The percentage of Health Care-Associated infection (HAI) is increasing day by day, causing a significant rise in the morbidity and mortality. The heat generated by the mobile, in turn, creates a prime breeding place for many organisms which are found on the skin. To find out the bacterial flora of the mobile phones before and after cleaning with 70% isopropyl alcohol, to isolate and identify any pathogenic organisms from the mobile phones of Health Care Professionals and to find out the antimicrobial resistance pattern of the isolated pathogenic strains. This Cross-sectional study was carried out in a tertiary care hospital for two months. A total no. of 100 mobile phones of health care professionals belonging to various clinical departments. Swabs were taken from the mobiles before and after cleaning with 70% isopropyl alcohol. There was bacterial growth on 72 mobile phones, the highest contamination was seen in mobiles of HCW in ICU. Mobile phones of doctors showed maximum contamination of 85%, followed by CRRI's mobiles with 70% and nurses 45%. The most common organism isolated was Micrococci followed by *Staphylococcus aureus* and Diphtheroids. In that Methicillin-resistant *Staphylococcus aureus* was 8% and ESBL *Escherichia coli* 5%. It is important to educate the health care workers regarding the decontamination of the phones with 70% isopropyl alcohol which in turn can reduce the risk of Hospital-acquired infections.

* Corresponding Author

Name: Dr. Kalyani M
Email: kalyanimohanram@gmail.com

ISSN: 0975-7538

DOI: https://doi.org/10.26452/ijrps.v9i4.1667

Production and Hosted by

IJRPS | https://ijrps.com


## INTRODUCTION

The percentage of Health Care-Associated (HAI) is increasing day by day causing a significant rise in the morbidity and mortality. These infections may in turn spread through various inanimate objects like the thermometers, instruments used in the OPD'S and wards. Of late, it has been found that one of the major sources of the spread of nosocomial infections is through the mobile phones of Health Care Professionals (HCP). Because of the benefits and secure usage of mobile phones for communication, the hazards of it have been overlooked. Microbiologists are of the opinion that a combination of the constant handling of the mobiles by the HCP exposes it to an array of microorganisms and the heat generated by it, in turn, creates a prime breeding place for many organisms which are in turn found on the skin. Hence mobile phones are rightly called the 'TECHNOLOGICAL PETRI DISH' for thousands of microorganisms (Nikhil N. Tambe, Chitra Pai, 2012). The awareness about mobile phone contamination in medical settings is increasing due to the possibility of cross-contamination of these

devices which can act as an environmental reservoir and source of bacterial cross-contamination, particularly in clinical areas such as operating theaters, intensive care units and burn units which are main area for spread of nosocomial infection (Shadi Zakai *et al.,* 2016).

According to the "Hospital Infection Society India" among the nosocomial infections, 28% of them are urinary tract infections, 19% of them are surgical site infections, 17% is due to pneumonia and 7-16% blood serum infections (Nikhil N. Tambe, Chitra Pai, 2012). This is because there is an alarming increase in the pathogens like *Escherichia coli, Staphylococcus aureus, Pseudomonas aeroginosa* etc. are found on the mobile phones. Staphylococci are also found regularly on clothes, bed linen, and other human environments (Sweta Dave and Kishor Shende, 2015). Many Multi-Drug Resistant (MDR) strains like Methicillin-Resistant *Staphylococcus aureus* (MRSA) and Extended-Spectrum Beta-Lactamase (ESBL) and Gram-negative bacilli are also isolated (Paul J. Rooney *et al.,* 2009).

The present study is 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 infections. It is also focused to show the necessity of cleanliness in handling personal objectives like cell phones carefully with a proper cover which would prevent the multiplication of microorganism

## METHODOLOGY

This Cross-sectional prospective study was carried out for two months at Saveetha Medical College Hospital, Thandalam, Kancheepuram District. A total of 100 mobile phones of doctors, house surgeons and nurses working in various departments of Surgery, Orthopedics, Medicine, Pediatrics, OBG and ICU were screened for the presence of bacterial flora and bacterial pathogens before and after decontamination with 70% isopropyl alcohol and the efficacy of isopropyl alcohol for decontamination was found out. Antibiotic sensitivity testing of the bacterial pathogens was found out in this study.

**Inclusion Criteria:** Mobiles used for more than 3 months were screened.

**Exclusion Criteria:** Mobiles used for less than 3 months were not screened.

An informed written consent was taken from the subjects. The questionnaire was filled up with all details. Sterile swabs were soaked in normal saline and were used for swabbing the front, back and sides of mobile phones. This was followed by decontamination of mobile phones with 70% isopropyl alcohol. After allowing it to dry for 10 minutes, repeat swab was taken from the cell phones.

These swabs were brought to the Department of Microbiology within one hour, where they were subjected to culture on blood agar and MacConkey agar. After incubation for 24 hours at 37°C, the growth obtained was identified by Gram staining, cultural characters and various biochemical tests following standard procedures (Usha Arora *et al.,* 2009). The pathogenic bacterial isolates were subjected to antibiotic sensitivity testing by Kirby-Bauer method (Miles R S, Amyes SGB, 1996) to find out the resistance pattern and the results were interpreted according to Clinical and Laboratory Standard Institute (CLSI) guidelines (CLSI, 2007).

**Statistical Analysis:** The data were collected, tabulated and analysed. Pearson's Chi-square test was used as a test of significance. A value of $p < 0.05$ was considered significant.

## RESULTS

Total number of samples in this study was 100 numbers, Of the 100 samples which were taken

**Table 1: Percentage of Bacterial Growth - Department Wise Split Up**

| S.No | Department | No. of samples | No of phones having bacterial growth. | Percentage of growth |
|---|---|---|---|---|
| 1 | Medicine | 20 | 16 | 22.2% |
| 2 | Surgery | 20 | 17 | 23.6% |
| 3 | OBG | 20 | 16 | 22.2% |
| 4 | Paediatrics | 15 | 8 | 11.1% |
| 5 | Orthopaedics | 15 | 13 | 18% |
| 6 | ICU | 10 | 9 | 12.5% |

**Table 2: Percentage of bacterial growth among the mobiles phones of HCP's**

| S. No | Designation | Number of samples taken | No.of phones showing bacterial growth | |
|---|---|---|---|---|
| 1 | Doctors | 50 | 42 | 84% |
| 2 | CRRI's | 30 | 21 | 70% |
| 3 | Nurses | 20 | 9 | 45% |

**Table 3: Bacterial Isolates**

| S.No | Organisms | doctors | | Cori's | | Nurses | |
|---|---|---|---|---|---|---|---|
| 1 | *S.aureus* | 9 | 18% | 6 | 20% | 3 | 15% |
| 2 | Micrococci | 11 | 22% | 8 | 26% | 5 | 25% |
| 3 | Diptheroids | 6 | 12% | 6 | 20% | 3 | 15% |
| 4 | *E.coli* | 4 | 8% | 3 | 10% | 4 | 20% |
| 5 | Aerobic spore bearers | 1 | 2% | 2 | 10% | 2 | 10% |
| 6 | GPB | 2 | 4% | - | - | 3 | 15% |

**Table 4: Resistant Pathogenic bacterial isolates**

| S No. | Organism | Drug sensitive | Drug resistant |
|---|---|---|---|
| 1 | *Staph aureus* (N=18) | 11 (MSSA) | 7 (MRSA) |
| 2 | *E.Coli* (N=11) | 7 | 4 (ESBL) |

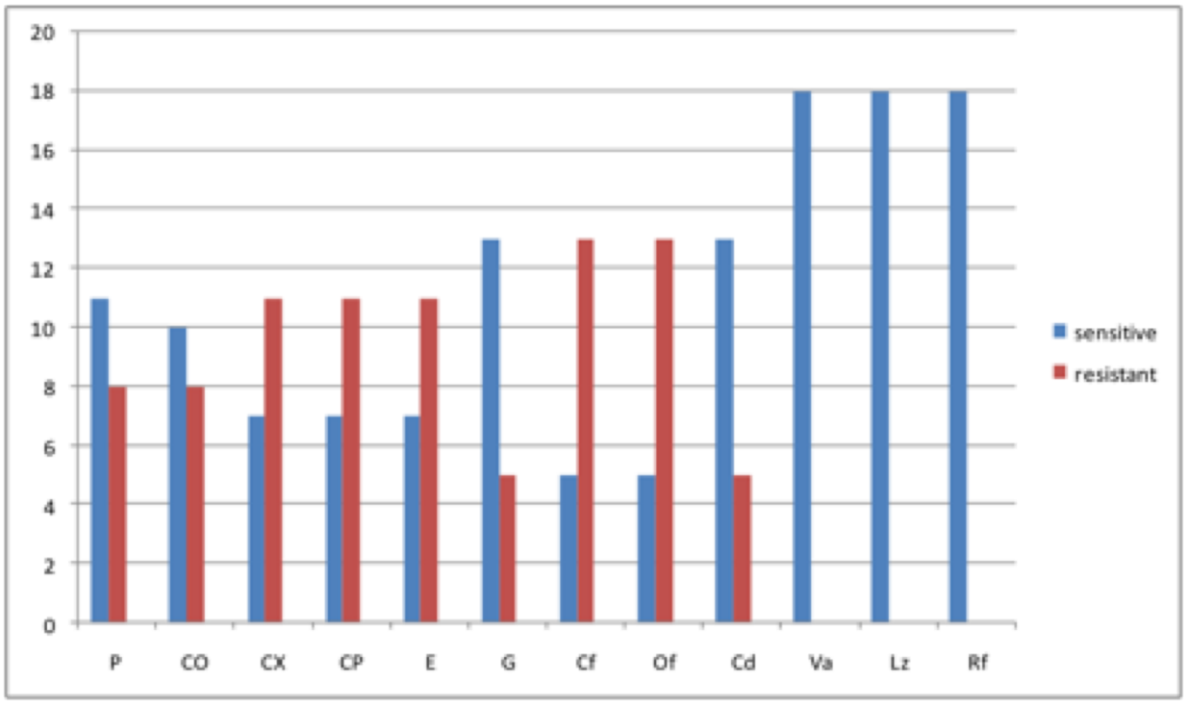


**Figure 1: Antimicrobial sensitivity testing for *S.aureus***

Antibiotic susceptibility pattern of *Staph aureus.* The drugs used were *Penicillin (P), Cotrimoxazole (Co), Cloxacillin (Cx), Cephalexin (Cp), Erythromycin (E), Gentamicin (G), Ciprofloxacin (Cf), Ofloxacin (Of), Clindamycin (Cl), Vancomycin (Va), Linezolid (Lz) Rifampicin (Rf).*

from the mobile handsets of Healthcare Professionals at Saveetha Medical College, 72% of samples showed positive bacterial growth before decontamination with 70% Isopropyl alcohol while the remaining 21% did not show any growth which is statistically significant. (p = 0.000)**.** The percentage of bacterial growth was compared across various departments which are shown in Table 1. Mobile handsets of HCP from Intensive care unit showed maximum growth (9 out of 10 nos) followed by those of Orthopaedics, Surgery, Medicine, Obstetrics and Gynaecology and the least with Paediatrics.

Table 2 shows the distribution of the samples among healthcare professionals. Among the mobile handsets that showed bacterial growth, 84% of doctors showed maximum growth (42 out of 50) followed by that of CRRI's which showed 21 out of 30 samples (70%) followed by nurses that showed 45% of growth and the differences were statistically significant. (p = 0.004). Some mobile handsets grew more than one type of isolates.

Table 3 shows the growth of bacterial isolates. Commonest organism isolated was Micrococci which is a skin commensal that showed 22% of total bacterial growth in the handsets of doctors, 26% in CORI'S and 25% in nurses. Among the pathogens, 18 isolates were *Staphylococcus aureus (Staph aureus)* and 11 isolates were *Escherichia coli (E.coli).*

The antibiotic susceptibility testing was done for the pathogens *Staphylococcus aureus* and Escherichia *coli.* Table 4 shows that among the 18 handsets that showed growth of *Staphylococcus aureus,* 11 isolates were sensitive (Methicillin-Sensitive *Staphylococcus aureus*- MSSA) and 7 were resistant

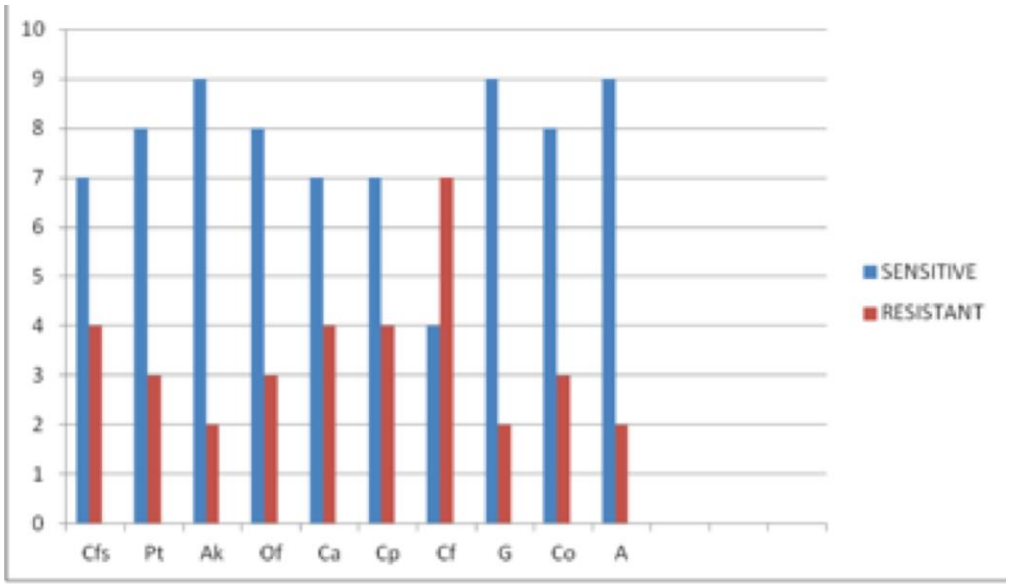


**Figure 2: Antimicrobial sensitivity testing for *Escherichia coli***

Antibiotic susceptibility pattern of *Escherichia coli.* The drugs used were *Cefaperazone-Sulbactum (Cfs), Piperacillin-Tazobactam (Pt), Amikacin (Ak), Ofloxacin (Of), Ceftazidime (Ca), Cephalexin (Cp), Ciprofloxacin (Cf), Gentamicin (G), Cotrimoxazole (Co), Ampicillin (A).*

Strains (Methicillin-resistant *Staphylococcus aureus* MRSA). Among the 11 strains of *Escherichia coli* 7 strains were sensitive and 4 were resistant strains (Extended-spectrum beta-lactamases ESBL). These resistant strains are important causes for hospital-acquired infections. After decontamination with 70% Isopropyl alcohol, only one device showed growth after the decontamination with 70% Isopropyl alcohol (Aerobic spore bearer which is a commensal)

## DISCUSSION

Mobile phones are often touched during various activities related to health care –examining the patients and providing nurse care. They are rarely cleaned and are frequently touched during or after examination of patients and handling of specimens without proper hand washing (Jaya Prakash Rao S *et al.,* 2016). Multiple usage and exposure of mobile phones to environmental microbes on the hand and skin of the users may have contributed to the level of isolation of bacteria from commercial phones in the present study (Deepak Kumar Verma *et al.,* 2015). Hence most of the mobile phones are contaminated with bacteria some of them being pathogenic. Some of the pathogenic organisms isolated cause nosocomial infections. The isolation of the bacteria in this study was 72%, when compared to the study conducted Braddy *et al., 2006* which was 96.2% and in the study conducted by Usha *et al.,* 2009 the percentage of bacterial isolation was 40.62%. This study also shows that the highest bacterial contamination of the phones was seen in the ICU's and the department of orthopaedics. This is by the study conducted by Ulger *et al.,* 2009, who showed that there is more bacterial contamination of mobiles in the ICU'S.

In our study, among the Gram-positive cocci, Micrococci and *Staphylococcus aureus* were the most common organisms isolated. This goes well with the studies conducted by Chithra Pai *et al.,* were *Staphylococcus aureus* was the most common organism isolated. This may be because *Staphylococcus aureus* and Micrococci are organisms which can survive to dry and can multiply well in warm environments.

In this study, many multidrug-resistant organisms were isolated, the most common being Methicillin-Resistant *Staphylococcus aureus* (MRSA) strains of *Staphylococcus aureus* (9.7%). The results according to the study conducted by Nikhil Tambe *et al.,* 2012, showed that MRSA bacterial contamination was 16.92%. The next Multi-Drug Resistant organism mainly isolated was Extended Spectrum Beta-lactamase (ESBL) strains of *Escherichia coli (E.coli)*, (Paul J. Rooney *et al.,* 2009) which showed 5.5% positive strains. The MRSA strains and the ESBL strains were mainly found in the mobile handsets of doctors from ICU'S where they could have been transmitted from one patient to another, causing nosocomial infections. The main reservoir of *S. aureus* is the hand from where it is transmitted to another person (Brande AI *et al.,* 1981).

In this study also, 99% of all the phones remained bacterial free after decontamination with 70%isopropyl alcohol, which was well correlating with that of findings of Usha *et al.,· Staph.aureus* showed

maximum sensitivity to Vancomycin, clindamycin, linezolid. *Escherichia coli* showed maximum sensitivity to Amikacin and Gentamicin. Hence healthcare workers should be educated about the significance of frequent cleaning of their phones.

## CONCLUSION

The isolation of bacterial flora was seen the most in the mobile phones of doctors. It is necessary to develop effective preventive strategies that will include environmental decontamination, hand hygiene, surveillance and contact isolation for the prevention of these nosocomial infections. Simple cleaning of computers and telephones with 70% isopropyl alcohol may decrease the bacterial load. Control measures are quite simple and can include engineering modifications, such as the use of hands-free mobile phones, surfaces that are easy to clean and disinfect, hand washing and the wearing of gloves by the appropriate personnel. In general, resident infection control staff of the medical facility can advise on the routine control practices for medical devices. Observance of these simple control procedures can decrease morbidity and mortality and thereby reduce medical care costs for hospitals and other care providers, in turn, helps in minimising the spread of nosocomial infections.

**Acknowledgement:** We acknowledge ICMR for funding (Short Term Studentship Project).

## REFERENCES

Brady RR, Wasson A, Stirling I, McAllister C, Damani NN. "Is your phone bugged, the incidence of bacteria known to cause nosocomial infection of health care workers. J Hosp Infect 2006; 62(1):123-5.

Brande AI, Davis CE, Fraser J. Foodborne microbiology infectious diseases. Philadelphia: W.B. Saunders Company; 1981. p. 1860.

Deepak Kumar Verma, Alemu Barasa, Dante Dara, Habtamu W/Medehen et al., Isolation and Characterization of Bacteria from Mobile Phones of Students and Employees at University of Gondar, Ethiopia Bull Pharm Res 2015; 5(3): 96-100.

Jaya Prakash Rao S, Rajeshwar Rao, Sasikala G, Swathi Nayani Bacterial Isolates from Mobile Phones of Health Care Workers in a Tertiary Care Hospital, Hyderabad Sch. J App Med Sci 2016; 4(7E): 2627-9.

Miles RS, Amyes SGB Laboratory control of antimicrobial therapy In Colle J G, Duguid JP, Frase AG, Marmion BP Mackie and McCartney practical medical microbiology 14th ed., Vol 2 Churchill Livingstone, London 1996.pp.152-54.

Sweta Dave, Kishor Shinde. Isolation and Identification of Microbes Associated with Mobile Phones in Drug District in Chhattisgarh Region, India. IOSR J Environmental Sci Toxicol Food Technol 2015; 1(6): 71-3.

Nikhil N. Tambe, Chitra Pai. A Study of Microbial flora and MRSA harboured by the Mobile Phones of Health Care Personnel. Int J Recent Trends Sci-Tech 2012; 4(1): 14-8.

Paul J. Rooney et al., Nursing homes as a reservoir of extended-spectrum β-lactamase (ESBL)-producing ciprofloxacin-resistant Escherichia coli. J Antimicrobial Chemotherapy 2009; 64(3): 635–41.

Performance Standards for Antimicrobial Disc Susceptibility Tests. CLSI 2007; 25(1):1

Shadi Zakai, Abdullah Machaut, Abdulmalik Abumohssin, Ahmad Samarkand *et al.,* Bacterial contamination of cell phones of medical students at King Abdulaziz University, Jeddah. Saudi Arabia J Microscopy Ultrastructure 2016; 4(3): 143-6.

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 Antimicrob 2009; 6(8):7.

Usha Arora, Pushpa Devi, Aarti Chadha, Sita Malhotra "Cellphones a modern stay house for Bacterial pathogens", JK Science Vol. 11 No. 3, July-September 2009