



Original Article:

Potential of Mobile Phones to Serve as a Reservoir in Spread of Nosocomial Pathogens

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Abstract: Objective: The use of cellular telephones by medical personnel and the associated nosocomial transmission of pathogens have not been thoroughly examined. The objective of this study was to determine the incidence of bacterial colonisation on mobile phones of Healthcare workers (HCWs) and its accompanying resistance to commonly used antimicrobials in a medical and dental hospital in India. **Method:** A total of 204 mobile phones of HCWs from medical and dental departments were screened. A sterile swab moistened with sterile saline was rotated over the external surface of the phone. Swabs were cultured on 5% sheep blood agar and MacConkey agar plates. Plates were incubated aerobically at 37°C for 24 hours. All isolates were tested for antimicrobial susceptibility. A questionnaire was used for data collection on mobile phone use in hospital. **Result:** 99% of the phones demonstrated evidence of bacterial contamination. 64.8% of medical samples showed growth of pathogenic micro-organisms and 37.9% showed growth of Multi drug resistant bacteria. 59.37% of dental samples showed growth of pathogenic micro-organisms and 43.75% showed growth of Multi drug resistant bacteria. Pathogens isolated included Methicillin-resistant *Staphylococcus aureus*, Methicillin-sensitive *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Acinetobacter*, *Enterococcus faecalis*, and *Pseudomonas aeruginosa*. According to the questionnaire 40% admitted to using their phones between examination of patients. Only 6% used disinfectants to wipe their phones. **Conclusion:** This study reveals that mobile phones are commonly used by HCWs, even during patient contact and may serve as a potential vehicle for the spread of nosocomial pathogens.

Key Words: Mobile phones; Bacterial Contamination; Nosocomial Infection

Introduction:

Despite overall progress, hospital acquired infections are a problem in both developed and developing countries. It significantly increases the patients' length of stay in hospital resulting in higher hospital costs. Such infections can be prevented by health care workers taking proper precautions when caring for patients. Source of infection may be exogenous such as from the air, medical equipment, hands of surgeons and other staff or endogenous such as the skin flora in the operative site, or rarely from blood used in the surgery.¹ The hands of health-

care workers play an important role in transmission of nosocomial pathogens.

With recent advances in the source of information, mobile phone use has become indispensable in hospitals.² The use of cell phones often occurs in hospital halls, laboratories, and/or intensive care units when dealing with severe illnesses. The Telecom and Regulatory Authority of India (TRAI, 2009-10) reported that the share of mobile phone users in India stood at 584.32 million as compared to 391.76 million a year before. The growth was 49.15% year-on-year.³ Mobile phones may transmit more than just information in today's busy hospitals. They may also be involved in the transmission of infections in the healthcare systems. Mobile phones are used in close contact with the body and, as for most non-medical electronic equipment, there are no cleaning guidelines available that meet hospital standards, and the hygiene risk involved in using mobile phones or has not yet been determined.

Thus, in this study, we investigated bacterial contamination of the mobile phones of the healthcare workers employed in a medical and dental institution in Mangalore, INDIA and its resistance to commonly used antimicrobials.

Methods:

A total of 204 mobile phones of HCWs from medical and dental hospital i.e. 12 each from Department of Paediatrics, General Medicine, Orthopaedics, Obstetrics-Gynaecology, Dermatology, ENT, Ophthalmology, General Surgery, Anaesthesiology, Pedodontics, Orthodontics, Oral Medicine, Oral Surgery, Community Dentistry, Endodontics, Periodontics and Prosthodontics were included in this study. A questionnaire was used for data collection on use of mobile phones in hospitals by personnel. Their profession, duration of their profession, whether they used their phones between patients, usage of phones with gloved hands and whether routine cleaning of phones was done were recorded.

The samples were collected aseptically using swabs moistened with sterile saline. Samples were collected by rotating the swabs over the mouthpiece, earpiece, keypad and external cover of the mobile phones and were streaked on 5% sheep blood agar and MacConkey agar plates, and were incubated at 37°C for 24 hours. Plates were observed for growth. Isolates were identified by colony morphology, gram staining and standard biochemical reaction.⁴ Gram positive catalase positive cocci were tested for mannitol utilisation and for production of co-

agulase enzyme. Gram positive catalase negative cocci were identified by bile esculin agar, oxidase and other biochemical tests including production of indole, utilisation of citrate, production of enzyme urease and triple sugar ion agar. The isolates were further subjected to antibiotic sensitivity testing by Kirby-Bauer disc diffusion method on Mueller-Hinton agar according to Clinical Laboratory Standards Institute antibiotic disc susceptibility testing guidelines.⁵

Results:

Out of the 204 phones screened in this study, 201 showed bacterial growth. Only 2 medical and 1 dental sample showed no growth. Polymicrobial growth was detected in 17 (17.7%) of dental samples and 42 (38.8 %) of medical samples (Figure 1). A higher percentage of mobile phones from departments of Periodontics, Endodontics and Oral Medicine were contaminated (Figure 2). The most commonly isolated organism was *Coagulase-negative Staphylococci* (CNS) (44). However, bacteria that might be associated with hospital infection were isolated in 154 samples including *Pseudomonas aeruginosa* (43), *Escherichia coli* (34), Methicillin-sensitive *Staphylococcus aureus* (29), *Klebsiella pneumonia* (16). Methicillin-resistant *Staphylococcus aureus* is one of the most frequently isolated bacteria in hospital infections and was isolated in 10 samples. Pathogens isolated also included *Acinetobacter spp*, *Enterococcus spp*, *Enterobacter spp* and *Diphtheroids*. (Table 1 shows the frequency of distribution of pathogens.)

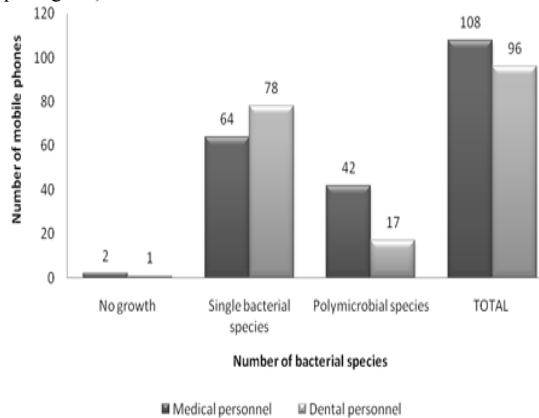


Figure 1: Extent of Mobile Phone Contamination in Medical and Dental Hospital

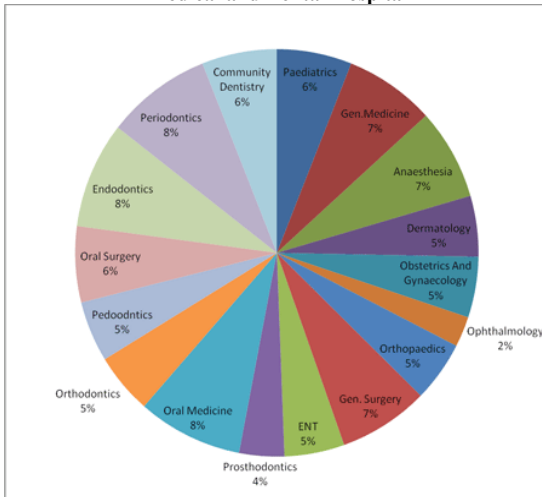


Figure 2: Percentage of Bacterial Contamination of Mobile Phones of Healthcare Workers in Various Departments

Table 1: Distribution of Bacterial Growth in Medical and Dental Departments

Organism isolated	Medical personnel		Dental personnel		All personnel
	personnel	%	personnel	%	
<i>Staphylococcus aureus</i> (MRSA)	4	40	6	60	10
<i>Staphylococcus aureus</i> (MSSA)	17	58.62	12	41.38	29
<i>Escherichia coli</i>	16	47.06	18	52.94	34
<i>Klebsiella pneumoniae</i>	11	68.75	5	31.25	16
<i>Pseudomonas aeruginosa</i>	27	62.79	16	37.21	43
<i>Acinetobacter spp</i>	6	50	6	50	12
<i>Enterococcus spp</i>	6	60	4	40	10
<i>Enterobacter spp</i>	1	100	0	0	1
<i>Citrobacter spp</i>	0	0	1	100	1
<i>Proteus</i>	0	0	1	100	1
<i>Diphtheroids</i>	0	0	1	100	1
<i>Coagulase-negative Staphylococci</i> (CNS)	23	52.27	21	47.73	44

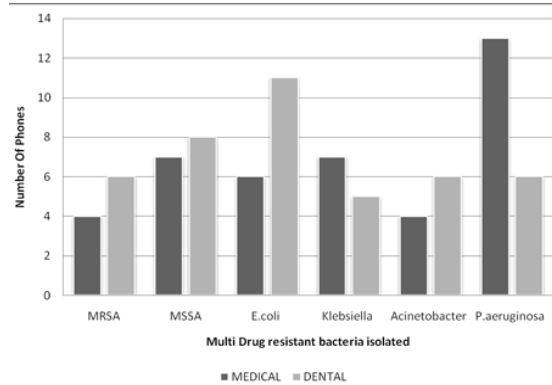


Figure 3: Microbiological Profile of Multi Drug Resistant Bacteria from Mobile Phones

Among medical samples, 64.8% were pathogenic and 37.9% showed growth of multiple drug resistant bacteria. 59.37% of dental samples showed growth of pathogenic micro-organisms and 43.75% showed growth of multiple drug resistant bacteria (Figure 3). According to the questionnaire, 99% of HCWs used cellphones in the hospital. 40% of HCW's admitted to using their mobile phones while attending to patients. Only 6 % of HCWs sometimes used an alcohol based disinfectant to wipe their mobile phones. Almost all the HCWs do not wash their hands after using their phones and before attending to patients. (96%). 36% of HCWs do not believe that cell phones can act as vector for spread of nosocomial infections from one patient to another and it can have harmful colonization. Most of them share cell phones with colleagues (90%) and at home (98%).

Discussion:

In the world over, maintaining hygiene standards is a prerequisite for healthy living. It is not uncommon however to observe shift in hygiene practices that deviate from normal standards of hygiene in both the developing and the developed world. Medical personnel use their cellular telephones excessively while in the hospital. The threat of contamination with potential pathogens is a valid concern. We found that one third of the cellular telephones that belonged to HCWs harboured varied and potentially pathogenic microorganisms. Several reports have documented the contamination of mobile phones among HCWs (Borer et al, 2005 ; Brady et al, 2006; Goldblatt et al, 2007; Jayalakshmi et al, 2008; Karabay et al, 2007).⁶⁻¹⁰ However, so far no study has determined the contamination of mobile phones in different departments in a hospital environment. Overall, the bacterial contamination was higher in the dental

departments as compared to the medical departments. This may be attributed to the fact that air contamination occurs in a dental clinic setup due to dissemination of bacterial aerosols when high speed dental equipment is used.¹¹ Ultrasonic scaling which is most commonly performed in the department of Periodontics is one of the most air-contaminant dental treatment procedures.¹²

The purpose of the study was to determine the presence of aerobic bacteria, so cultivation of anaerobic bacteria and fungi was not done. Simultaneous cultures from the hands of HCWs or environmental surfaces were not carried out; this is a limitation of the study.

If the same phones are used both outside and inside of hospitals, our results indicate that, these contaminated phones can play a potential role in the spread of hospital infection bacteria in the community. HCWs should be aware that their cellular telephones may carry potentially pathogenic bacteria that may affect not only patients, but also their loved ones at home.

MRSA is one of the most frequently isolated bacteria in hospital infections and was isolated in 10 samples and is a cause for concern. This represents an additional route for cross-transmission of MRSA. MRSA isolates are often resistant to multiple commonly used antimicrobial agents. Recent estimates by the Centers for Disease Control and Prevention indicate that more than 125,000 hospitalizations because of MRSA occurred in the United States between 1999 and 2000, a rate of 3.95 cases per 1,000 hospital discharges.¹³ MRSA infections usually develop in hospitalized patients, but recent reports emphasize the emergence of serious community-acquired MRSA infections.^{14,15} Most organisms die within hours due to dehydration but bacteria such as *S. aureus* and *Acinetobacter* are resistant to drying and survive for weeks and multiply rapidly in a warm environment.¹⁶⁻¹⁹

Our phones are ideal breeding sites for these microbes as they are kept warm and snug in our pockets and handbags. Also, there are no guidelines for the care, cleaning and restriction of mobile phones in our health care settings. Hence, in a country like ours, mobile phones of HCWs play an important role in transmission of infection to patients, which can increase the burden of health care. Simple measures such as increasing hand hygiene and regular decontamination of mobile phones with alcohol disinfectant wipes may reduce the risk of cross contamination caused by these devices. One study reported the use of 70 % isopropyl alcohol as an effective disinfectant.⁹ Another study reported that restricted use of mobile phones during working hours along with proper hand hygiene practices enabled mobile phones to remain free of contamination (Goldblatt et al, 2007).⁸

In summary, since restrictions on the use of mobile phones by Healthcare workers in hospitals is not a practical solution, we suggest that Healthcare workers should practice increased adherence to infection control precautions such as hand washing after each use of the telephone. In addition, they should be informed that these devices may be a source for transmission of hospital-acquired infections. Further studies for the possible methods of decontamination of mobile phones, such as using alcohol and/or disinfection tissues, should be conducted in hospitals.

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