

THE MOBILE PHONE IN A TROPICAL SETTING – EMERGING THREAT FOR INFECTION CONTROL

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ABSTRACT:

Introduction: Mobile phones have become an extension of office practice for physicians; they act as perfect substrate for microorganisms, especially in hot humid conditions, and may serve as a vehicle in transmitting nosocomial infections.

Objective: This study was conducted to determine whether mobile phones of healthcare workers (HCWs) and corporate office goers harbour microorganisms since they represent two different environments.

Methods: Swabs were taken from mobile phones surfaces, inoculated in Blood agar and MacConkey agar and thioglycollate medium, and incubated aerobically. Growth was identified as per standard microbiological procedures. Antibiotic susceptibility was determined for *S.aureus*. Questionnaire was used for data collection on awareness of mobile phones usage and disinfection.

Results: In all, 51 HCW and 36 corporate mobile phones were sampled. Polymicrobial growth was detected in 71% HCW and 78% corporate mobile phones respectively. Pathogens isolated from HCW samples included *S.aureus* [MSSA (4), MRSA (2)], *E.coli* (1), *K.pneumoniae* (1), *Ps.aeruginosa* (1) and CONS (43). Among 78 bacterial isolates from corporate office samples, 54% were pathogenic. Only 12% HCWs used disinfectants to wipe their mobile phones.

Conclusion: High level of contamination irrespective of the environment is disturbing. Isolation of MRSA from HCWs mobile phones is a cause for concern, indicating the potential threat of mobile phones spreading infections and the importance of hand hygiene to prevent infection.

MeSH words: Gram-positive cocci, Gram-negative bacteria, cellular phone, handwashing, MRSA

INTRODUCTION

Global burden of healthcare associated infections (HAI) is on the rise, and contributes significantly to morbidity and mortality of patients[1]. Increase in HAI is concomitantly associated with increase in expenditure for healthcare facilities[1]. Majority of HAI are inadvertently transmitted through hands of healthcare workers (HCWs), the environment being the source of nosocomial agents occasionally[2].

Inanimate objects in the hospital environment are known to be contaminated with microorganisms[2]. Mobile phones have become an extension of office practice for physicians, and may serve as perfect substrate for microorganisms, especially in high temperature and humid conditions. Extensive use of mobile phones by HCWs acts as a vehicle for transmission of nosocomial agents.

There are few reports on the role of mobile phones in the spread of nosocomial infections[3,4,5,6,7] especially in a tropical setting[8]. This study was undertaken to determine whether mobile phones of HCWs only are contaminated, since they are used in an environment that

harbours nosocomial agents or whether mobile phones of corporate office goers are also contaminated since it represents an environment free from contamination.

Materials and methods

Surface samples were taken from mobile phones of HCWs from a tertiary care centre and non-hospital (corporate) personnel in June – July 2007 after obtaining consent. The corporate office that was sampled is located in the centre of Chennai city, in a very urban location, completely air-conditioned, well maintained, dust-free environment, the nature of work being mainly administrative. Sterile swabs moistened with sterile demineralised water were rotated over both the surfaces of the mobile phone or the casing surface for cased mobile phones and collected. Sampled swabs were streaked over Blood agar and MacConkey agar plates, and inoculated in thioglycollate medium (Hi-Media Company Limited, India) for characterization of aerobic bacteria; no anaerobic/fungal cultures were taken. Plates were incubated aerobically at 37 °C for 24 - 48 h. Gram-positive and Gram-negative bacteria were identified as per standard microbiological procedures[9].

Gram-positive cocci were identified by Gram staining, colony morphology, and haemolysis. Staphylococci were further identified based on catalase, slide- & tube- coagulase, and utilisation of OF-glucose and mannitol. Gram-negative bacilli were identified by Gram staining, colony morphology, lactose fermentation, and motility, and further biochemical tests like indole production, sugar fermentation and H₂S production, urease production, citrate utilization, and MR-VP test for the nature of fermentation. Non-fermenters were further identified using catalase and oxidase tests,

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ability to grow on MacConkey agar and growth at 42 °C, and biochemical tests like OF-dextrose utilisation, nitrate reduction and gelatin hydrolysis. Antibiotic susceptibility test was done for *Staphylococcus aureus* isolates by Kirby-Bauer Disc diffusion method.

RESULTS

In all, 51 mobile phones of HCWs and 36 of corporate office goers were sampled. Among the mobile phones sampled, 94 % were contaminated and only 6 % were free of aerobic bacterial growth. Majority (74 %) of the mobile phones had polymicrobial growth; 48 % had two species and 26 % had three or more species (Figure 1). Polymicrobial growth was documented in a larger number (71 %) of mobile phones belonging to HCWs. A total of 89 bacterial isolates were isolated from mobile phones of HCWs, of which 58 (65 %) were pathogenic. Commonly isolated pathogens from

mobile phones were *S. aureus* (6) [MRSA (2), MSSA (4)], *Escherichia coli* (1), *Pseudomonas aeruginosa* (1), *Acinetobacter* spp. (6) and *Klebsiella pneumoniae* (1) and Coagulase-negative Staphylococci (CONS) (43) as shown in Table 1. A higher percentage (42 %) of mobile phones of doctors was contaminated.

Among 79 bacterial isolates in 36 samples from corporate personnel, 43 (54 %) were pathogens. Polymicrobial growth was detected in 28 (78 %) mobile phones of office users. MSSA (1), *E. coli* (2), *Pseudomonas aeruginosa* (3), *Acinetobacter* spp. (16) and *Klebsiella pneumoniae* (1) and CONS (20) were the commonly isolated pathogens.

Analysis of the questionnaire showed that 38 (75%) HCWs and 11 (37%) of corporate users were aware that mobile phones harbour microorganisms and transmit infectious agents. Only 12 % HCWs used disinfectants to wipe their mobile phones. Majority (73%; n = 37) of the HCWs felt the need for restricted usage of mobile phones during working hours, especially in critical areas, while 18% (9) felt it as unnecessary and impractical. It was also found that 29% of HCWs followed restricted usage of mobile phones (less than three times) and 57% handled mobile phones more than three times to a maximum of 20 during working hours; 14% used greater than 20 times.

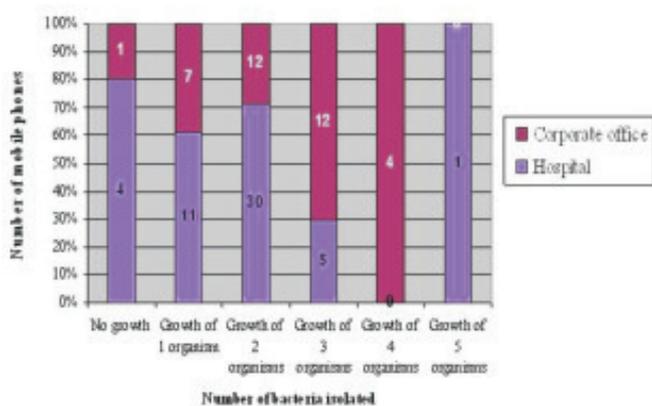


Table 1 : Microbiological Profile of Isolates from Mobile Phones

ORGANISMS ISOLATED	HEALTHCARE PERSONNEL	CORPORATE PERSONNEL
GRAM-POSITIVE BACTERIA		
<i>Staphylococcus</i> spp.		
Methicillin Resistant <i>S. aureus</i>	2 (2 %)	0
Methicillin Sensitive <i>S. aureus</i>	4 (5 %)	1 (1 %)
Coagulase-negative Staphylococci	43 (48 %)	20 (25 %)
Micrococci	19 (21 %)	19 (24 %)
Aerobic spore bearers	12 (14 %)	17 (22 %)
GRAM-NEGATIVE BACTERIA		
<i>Escherichia coli</i>	1 (1 %)	2 (3 %)
<i>Klebsiella</i> spp.	1 (1 %)	1 (1 %)
<i>Pseudomonas</i> spp.	1 (1 %)	3 (4 %)
<i>Acinetobacter</i> spp.	6 (7 %)	16 (20 %)

DISCUSSION

Few reports have documented the contamination of mobile phones among HCWs;[3,4,5,6,7,8] so far no study has ascertained the contamination of mobile phones with microorganisms among the general public external to the hospital environment. The mobile phones of corporate office-goers are representative of a non-hospital environment; they represent a relatively cleaner environment in a tropical country. Results of our study indicate that a high percentage of mobile phones of HCWs and office goers are contaminated. Since majority of the mobile phones are contaminated with microorganisms, it is likely that the contamination occurs via hands irrespective of the environment. The profile of microorganisms isolated from mobile phones in our study is similar to previous reports[3,4,5,6,7,8]. It is indeed surprising to document the presence of pathogenic organisms such as *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Acinetobacter* spp., *Klebsiella pneumoniae*, and *E. coli* in the mobile phones of corporate users. While CONS and Micrococci were the predominant isolates among Gram-positive cocci, the isolation of MRSA in a small percentage (2 %) is a cause for concern. This represents an additional route for cross transmission. The percentage of isolation of Gram-negative bacilli may show some geographic disparity. *Acinetobacter* was commonest isolate among Gram-negative bacilli. A study from Israel has shown *Acinetobacter* to be the predominant isolate recovered from cell phones[6]. Most organisms are killed within hours due to drying but bacteria

like *Staphylococcus aureus* and *Acinetobacter* are resistant to drying and can survive for weeks and multiply rapidly in warm environment[10]. It is not clear whether the source of Gram-negative bacilli is from the environment since surface sampling of the environment was not undertaken in this study.

Analysis of the questionnaire has shown that only 12% of the HCWs wipe mobile phones with disinfectant. There is an urgent need to disseminate knowledge among HCWs regarding the possible contamination of mobile phones and the importance of periodic cleaning of the phones, as well as the importance of hand hygiene. One study reported use of 70 % isopropyl alcohol to be effective as a disinfectant[8]. Another study reported that restricted usage of the mobile phones during working hours along with proper hand hygiene practices enabled to maintain the mobile phones free of contamination.

This study has certain limitations. The purpose of the study was to determine the presence of aerobic bacteria; cultivation of anaerobic bacteria and fungi was not done. Surface sampling of the environment and cultures from the hands of the personnel were not done. It is not possible to conclude from the study whether the organisms are transient or resident, since only one time sampling was conducted. Further studies on simultaneous surface sampling may enable identification of possible sources of contamination.

To our knowledge, this is the first report that has studied the potential for mobile phones to harbour microorganisms in both hospital and non-hospital settings. The high level of contamination of mobile phones irrespective of the environment is disturbing. Isolation of nosocomially significant pathogens such as MRSA, *Pseudomonas aeruginosa*, *Acinetobacter* spp. in HCWs' mobile phones demonstrates a hitherto unsuspected source of transmission of nosocomial agents. The presence of pathogenic organisms among mobile phones of corporate users is surprising, raising the concern for the spread of infectious agents to family, especially children. The presence of bacteria in both mobile phones suggests that hands may be the source of contamination of the mobile phones.

Infection control guidelines must target use of suitable disinfectants to avoid mobile phone contamination, and advocate hand-wash prior to and after mobile phone usage. Policy makers of individual healthcare facilities should formulate specific protocols for restricted use of mobile phones in sensitive patient care areas and make recommendations for periodic disinfection. Lack of awareness regarding the possibility of mobile phone contamination occurring in their grooves and keys (though they appear to be clean and shiny) suggest the need for creating awareness and ensuring hygienic practices in its handling.

ACKNOWLEDGEMENT:

The authors thank all the participants of the corporate office for their willingness to participate and appreciate the authorities of the corporate office to permit the conduct of study.

Potential conflict of interest : Nil

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