BACTERIAL CONTAMINATION ASSOCIATED WITH THE MOBILE PHONES OF HEALTHCARE WORKERS

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ABSTRACT

Background: Despite improvements in modern diagnosis and therapies, hospital acquired infections remain a leading problem of global health systems. Healthcare workers mobile phones are a reservoir for potential pathogens. Even if the high possibility of being contaminated, mobile phones are rarely clean and are often touched during or after examination of patients and handling of specimens without proper hand washing. **Aim**: The main objective of the present study was to isolate, identify different types of bacteria and their antibiotic susceptibility pattern from mobile phones of healthcare workers. **Materials and Methods**: Total 100 swab samples were collected aseptically by rolling over the exposed surfaces of the mobile phones inoculated on the agar plates and incubated aerobically. After incubation, plates were examined for bacterial growth. Bacteria were identified and antibiotic sensitivity was tested as per standard microbiological procedures. **Observation and Result**: All of the tested mobile phones (100%) were contaminated with either single or mixed bacterial agents. The most prevalent bacterial contaminants were Pseudomonas spp. and Escherichia coli followed by Coagulase-negative staphylococci. On the basis of antibiotic susceptibility test, it has been observed that most of the isolated bacteria became resistant to antibiotics, when compared to other isolates. **Conclusion:** We found that mobile phones are potential vectors which spread antibiotic resistance among microorganisms. So, full guidelines about restricting the use of mobile phones in clinical environments, hand hygiene, and frequent decontamination of mobile phones are recommended to limit the risk of cross-contamination and healthcare-associated infections.

KEYWORDS: Contamination, Healthcare Workers, Mobile Phones, Nosocomial Infection.

INTRODUCTION

Mobile phones have become one of the most indispensable accessories of professional and social life. They are increasingly becoming an important means of communication worldwide being easily accessible, economical and user-friendly. They are widely used by the healthcare workers (HCWs) and non-HCWs equally in every location. With all the achievements and benefits of the mobile phone, it is easy to overlook the health hazard it might pose to its many users.[1] The human skin is constantly in contact with micro-organisms and becomes readily colonized by certain microbial species. The adult human is covered with approximately $2m^2$ of skin, with surface area supporting about 1012 bacterial cells/person.[2] During a phone call, the mobile phone comes into close contact with contaminated human body areas with hands to hands, and hands to other areas like mouth, nose and ears,[3] which may result in colonization of potential pathogens present on the human skin, on the mobile phones. In 1997, Aronson et al. first suggested the infection potential of telephones.[4] The constant handling of mobile phones by users in hospitals (by patients, visitors and HCWs, etc.) makes it an open breeding place for transmission of microorganisms, as well as healthcare associated infections (HAIs). This is especially so with those associated with the skin due to the moisture and optimum temperature of human body especially our palms.[5] These factors and the heat generated by mobile phones contribute to harboring bacteria on the device at alarming levels. When we consider a phone's daily contact with the face, mouth, ears, and hands, the dire health risks of using germ-infested mobile devices are obvious.[6] Unlike our hands, which is easily disinfected using alcohol-based hand rubs (ABHRs) that are made available readily across all hospitals and medical facilities; our mobile phones are cumbersome to clean. We even rarely make an effort to disinfect them. As a result, these devices have the potential for contamination with various bacterial agents.[7] It is noted that sharing of microbial contaminated mobiles phones within HCWs and non-HCWs could spread potentially pathogenic bacteria to

the community. The presence of antibiotic resistant microorganisms on the surface of mobile phones of HCWs in hospitals poses a threat to public health.[8] Since there are no data on the risk of bacterial contamination of personal mobile phones among HCWs in this locality, this study was undertaken to establish a baseline of data on types of bacterial isolates and antibiotic sensitivity patterns.

MATERIALS AND METHODS
Study design: It is hospital based cross-sectional study.
Sample size & duration: A total of 100 swab samples were collected from the mobile phones for a period of 3 months from December 2014 to February 2015.
Study area: This study was conducted in Bacteriology section, Department of Microbiology, Sir Sayajirao General Hospital (S.S.G.H.) & Medical College, Vadodara Gujarat, India.
Inclusive criteria: Healthcare workers using mobile phone.
Exclusion criteria: The only exclusion criteria were the lack of mobile phone ownership.

METHODOLOGY
Sample Collection: Samples were collected aseptically with sterile swabs moistened with sterile normal saline and by rolling over the exposed surfaces of the mobile phones. In case of mobile phones with covers, the swab was taken from the outer surfaces of the cover in addition to the screen of the mobile phone. We used alcohol sanitizer to disinfect hands of data collector before swabbing each mobile phone, to prevent cross contamination.

Sample inoculation: After collection, the samples were immediately transported to the laboratory and inoculated on Nutrient agar and MacConkey agar and plates were incubated aerobically at 37°C for 24 hours. After incubation, plates were examined for growth and colony morphology of the isolates. Gram-positive and Gram-negative bacteria were identified as per standard microbiological procedures and biochemical reactions.

Collection of data: The data were compiled in Microsoft Excel sheet which was analyzed using Statistical Package for the Social Science (SPSS) computer software version 17.0 for Windows to determine any significant co-relationship exist between prevalence of contamination of mobile phones of HCWs and their area of work.

RESULTS
The present work was conducted on 100 mobile phones from HCWs in S.S.G.H & Medical College, Vadodara, Gujarat, India. The rate of bacterial contamination of HCWs mobile phones in this study was 100%. The current work revealed that the majority of isolated bacterial contaminants were mixed with more than one organism. From 100 HCWs mobile phones, 206 bacteria were isolated. Among HCWs, samples were collected from doctors, nursing staff, medical students and technicians working in various departments like laboratory, Intensive Care Units (ICUs), Operation Theater (O.T.) and general wards.

Table: 1. Numbers and types of bacteria isolated from HCW's mobile phones with %.

Isolated Organisms (n=7)	Number of Organisms isolated (n=206)	Percentage (%)
Pseudomonas aeruginosa	53	25.73
Acinetobacter baumannii	27	13.11
Klebsiella pneumoniae	22	10.68
Citrobacter spp.	09	4.37
Escherichia coli	44	21.36
Staphylococcus aureus	18	8.74
Coagulase Negative Staphylococci (CONS)	33	16.02

From table: 1, we found that in our study, among bacterial spp. isolated, highest prevalent spp. was Pseudomonas spp. and least prevalent spp. was Citrobacter spp.

Table: 2. Distribution of HCW's mobile phones samples according to profession and area.

Area	Doctors	Nurses	Technicians	Students	Area wise distribution of samples
Laboratory	04	-	08	04	16
ICUs	05	08	06	02	21
Operation Theater	10	16	05	04	35
General wards	08	14	03	03	28
Total	27	38	22	13	100

Table: 2 showing number of samples collection distributed among profession and area.
Table: 3. Antibiotic susceptibility pattern of Gram-negative bacteria isolated from HCW's mobile phones.

Antibiotics verses Organisms isolated	Cefoperazone-sulbactam		Piperacillin-Tazobactum		Gentamycin		Levofloxacin		Cefapime		Cefotaxime		Amikacin		Meropenem	
	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Pseudomo-nas aeruginosa (n=53)	50	03	50	03	48	05	49	04	51	02	46	07	45	08	53	00
Acinetobac-ter baumannii (n=27)	25	02	26	01	20	07	25	02	15	12	20	07	17	10	25	02
Klebsiella pneumoniae (n=22)	17	05	20	02	15	07	21	01	12	10	10	12	17	05	21	01
Citrobacte-r spp. (n=09)	08	01	09	00	07	02	09	00	05	04	05	04	08	01	09	00
Escherichi-a coli (n=44)	38	06	44	00	38	06	40	04	30	14	35	09	34	10	40	04

From table: 3, we found that gram negative bacteria isolated from mobile phones of HCWs show more sensitivity toward Levofloxacin, Meropenem and Piperacillin-Tazobactum, whereas shows more resistance towards Gentamycin, Cefapime and Cefotaxime.

Table: 4. Antibiotic susceptibility pattern of Gram-positive bacteria isolated from HCWs mobile phones.

Antibiotics verses Organisms isolated	Penicillin		Oxacillin		Cefoxitin		Vancomycin		Linezolid		Gentamycin		Azithromycin		Clindamycin	
	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Staphylococ-cus aureus (n=18)	08	10	18	00	17	01	15	03	18	00	16	02	15	03	17	01
Coagulase Negative Staphylococci (CONS) (n=33)	20	13	33	00	30	03	25	08	24	09	26	07	25	08	28	05

From table: 4, we found that, gram positive bacteria isolates shows higher sensitivity toward Oxacillin, Clindamycin and Cefoxitin, whereas shows higher resistance toward Vancomycin and Azithromycin.

DISCUSSION

This study aimed to investigate the bacterial contamination of mobile phones of HCWs in S.S.G.H & Medical College, Vadodara, Gujarat, India. In this study, mobile phones used by HCWs in various departments in the hospital, including laboratory, ICUs, O.T. and general wards showed high contamination with bacterial pathogens. Some mobile phones were colonized with non-pathogenic bacteria, especially those bacteria that constitute the normal flora of the skin, such as CONS. This is partially similar to other studies which reported CONS as the most common organisms isolated from HCW's mobile phones in clinical settings.[9] CONS have relatively low virulence, but are becoming increasingly recognized as the most common cause of nosocomial bacteremia associated with indwelling devices.[10] Despite the fact that CONS are considered non-pathogenic in normal circumstances, their presence in high levels on objects with frequent hand contact like mobile phones in settings like ICUs may pose a risk of bacteremia in immune-compromised patients.[7] Acinetobacter species have been frequently identified as a cause of widespread hospital outbreaks, including those in ICUs.[11] Total 155 (75.24%) gram-negative bacteria were identified in present study, of which 27 (13.11%) were Acinetobacter species. The rate of contamination with Acinetobacter spp. is consistent with other studies, which reported that between 1% and 12% of HCW's mobile phones were contaminated by Acinetobacter species.[9] Another organism identified in our study was Pseudomonas spp., which was found to be showing more sensitivity towards levofloxacin & meropenems. 44(21.36%) Escherichia coli was isolated, which suggests low level of mobile phone hygiene and hand hygiene since this organism is part of the intestinal flora; and among the leading causes of hospital associated infections. Our study showed that HCWs who have ever disinfected their mobile phones were less likely to have contaminated mobile phones compared to HCWs who have never disinfected their mobile phones. Previous studies have demonstrated that the microbiological profile of the HCW's mobile phones correlates with the pathogens isolated from the HCW's hands, which may indicate that mobile phone contamination might be a predictor for hand contamination[12, 13], and hence hand hygiene. Approximately, 70% of HCWs thought that

mobile phones can play a role in spreading infections in healthcare settings. But 65% of HCWs opposed banning the use of mobile phones in their units. This is slightly lower than what has been reported in a study from UK, in which 78.0 % of HCWs opposed banning the use of mobile phones in hospitals.[9] It is more sensible to increase the awareness about mobile phones disinfection rather than trying to forcefully ban using mobile phones in clinical settings. This is the first study that investigated the prevalence of contamination of HCWs mobile phones and their microbiological profile in all laboratories, ICUs, Operation Theaters (O.T.) and general wards in S.S.G.H & Medical College, Vadodara. Our findings highlight the need for a more comprehensive approach to reduce nosocomial infections, which in addition to promoting hand hygiene also focus on cleanliness of mobile phones and other objects that clinicians may carry. Only minority of HCWs have ever disinfected their mobile phones, which is not an optimal practice and highlights the need to increase the awareness about mobile phones disinfection.

CONCLUSION

Antibiotic resistance in bacterial species is increasing day by day especially in healthcare areas, where even the mobile phones of healthcare workers spreading susceptible bacteria and multidrug-resistant bacteria causing dangerous nosocomial infections. Regular cleaning of mobile phones with wet wipes and frequent hands washing should be encouraged to reduce any transmission of diseases and there should be regulations around the use of mobile phones in hospital settings due to their potential to contribute to nosocomial infections.

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