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### Original Article

## Cell Phones – Homes For Microbes!

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#### ABSTRACT

**Background:** Cell phones are in close contact with the body and serve as reservoirs of infection allowing the transportation of the contaminating bacteria to many different clinical & non-clinical environments. Further sharing of cell phones between HCWs (Healthcare workers) & non-HCWs may distinctly facilitate the spread of potentially pathogenic bacteria to the community. **Objectives:** To study the bacterial flora present on the cell phones of HCWs and to compare it with that found on cell phones of non-HCWs in terms of composition and antibiotic sensitivity. **Materials & Methods:** A total of 100 samples from the cell phones of HCWs and non-HCWs were collected from the surfaces of the cell phones. The swabs were inoculated on Mac Conkey's, Blood Agar and Sabouraud's Dextrose Agar plates. Bacterial isolates were identified using standard methods & Antimicrobial Susceptibility Test was performed as per CLSI standards. **Result:** Of the 50 samples from HCWs 10 were contaminated with *S. aureus*, 4 CONS, 1 *E. coli* & *Pseudomonas* spp. together. Of the 10 *S. aureus* 40% were resistant to methicillin & >1 organism was found in 2 samples. Of the 50 samples from Non-HCWs 18 were contaminated with *S. aureus* of which 50% were MRSA and 6 CONS. No fungus was isolated. **Conclusion:** To prevent the spread of potential pathogens through mobile phones, training of the HCWs about strict infection control practices, hand hygiene, environmental disinfection, routine decontamination of mobile phones with alcohol and discouraging sharing of phones between HCWs & Non-HCWs, should be done to prevent the spread of infection in hospital settings.

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### 1. Introduction

Cell phones are increasingly becoming an important means of communication worldwide being easily accessible, economical and user-friendly. They are widely used by the Health Care Workers (HCWs) and non-HCWs equally in every location. They are in close contact with the body and serve as reservoirs of infection allowing the transportation of the contaminating bacteria to many different clinical & non-clinical environments. Further sharing of cell phones between HCWs & non-HCWs may distinctly facilitate the spread of potentially pathogenic bacteria to the community [1]. The risk of infection involved in using mobile phones in the hospital settings has not yet been determined as there are no cleaning guidelines available that meet the hospital standards. Although the contamination of cell phones of HCWs has been studied little

information regarding the contamination of personal cell phones of the people in community exists. Bacterial flora on cell phones of HCWs may vary in composition, number and sensitivity to that found on cell phones of non-HCWs [1]. A variety of other objects like stethoscopes, blood pressure cuffs, bronchoscopes, patients' files, writing pens, computer hardware and even the dry surfaces have already been reported as vectors for potentially pathogenic microorganisms from HCWs to patients [1,2,3,4,5,6,7,8]. So here we studied the bacterial flora present on the cell phones of HCWs and compared it with that found on cell phones of non-HCWs in terms of composition, number and antibiotic sensitivity as this would help generate information regarding the carriage of potential pathogens on cell phones of HCWs & Non-HCWs of our area.

### 2. Materials & Methods

The present study was conducted in Department of Microbiology associated with Dhiraj General Hospital, a tertiary healthcare centre, catering to the healthcare needs of the people in and around Piparia village, Vadodara district. The samples of the cell phones of the subjects from hospital & community were

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collected with informed consent & without prior intimation, using a sterile cotton swab moistened with sterile normal saline. The swabs were rolled over all the exposed outer surfaces/sides of the cell phones used for ≥1 month, making sure that the keypad were swabbed as these are the most frequently used areas.

A total of 50 samples from HCWs (consultant doctors = 10, residents + interns = 10, nurses = 10, technicians = 10 and student nurses = 10) and 50 non-HCWs (institutional bus drivers = 10, institutional administrative staff = 10, labourers = 10, food joint staff = 10 and other professionals = 10) were collected.

The collected samples were streaked onto suitable media like Blood agar and Mac Conkey's agar, incubated overnight at 37°C for bacterial isolation and Sabouraud's agar incubated at room temperature and examined weekly for fungal isolation for 4 weeks.

Bacterial isolates were identified on the basis of Gram staining and appropriate biochemical tests.[9] For bacterial isolates, antibiotic susceptibility test (AST) was performed using Kirby-Bauer disc diffusion method on Mueller-Hinton agar (MHA) according to CLSI antibiotic disc susceptibility guidelines [10]. For Gram positive cocci Gentamicin, Cefoxitin, Gatifloxacin, Penicillin & Vancomycin were tested whereas for Gram negative bacilli Amikacin, Gentamicin, Imipenem, Ciprofloxacin & Ceftazidime were tested. Staphylococcus aureus were confirmed as MRSA by testing with a Cefoxitin disc (30µ); E. coli & Pseudomonas were screened for ESBL & MBL production as per CLSI guidelines. All media used for isolation & identification as well as the antibiotic discs for AST were obtained from HiMedia.

**3. Results**

Of the total of 50 samples from cell phones of HCWs, 15 were found to be contaminated with bacteria whereas 24 out of 50 Non-HCWs were found to be contaminated.

Of the 15 contaminated cell phones of HCWs 40% belonged to nurses while 26.66% belonged to the consultant doctors, the percentage of the other HCWs with contaminated cell phones is shown in Table 1.

**Table 1: Distribution of contaminated cell phones among HCWs**

Health Care Workers	No. of contaminated cell phones	Percentage
Consultant Doctors	04	26.66%
Nurses	06	40%
Interns & Residents	03	20%
Student nurses	00	0.00%
Technicians	02	13.33%
Total	15	

As shown in Table 2, of the 24 contaminated cell phones of the Non-HCWs the maximum belonged to the labourers on campus of the institute followed by the food joint staff of campus canteen.

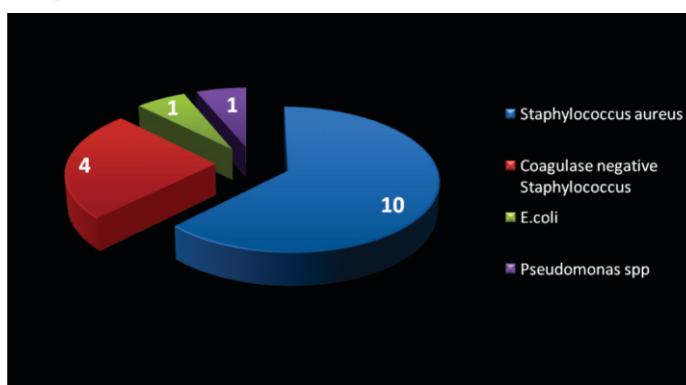
As shown in Chart 1, of the 15 samples from HCWs 66.66% were contaminated with S. aureus, 26.66% with CONS, 6.66% was contaminated with E. coli & Pseudomonas spp. together. More than 1 organism was found in only 1 sample.

S. aureus was the most commonly isolated organism (18/24) whereas (6/24) were CONS from the cell phones of Non-HCWs.

**Table 2: Distribution of contaminated cell phones among Non-HCWs**

Non-Health Care Workers	No. of contaminated cell phones	Percentage
Bus Drivers	05	20.83%
Administrative Staff	02	8.33%
Food Joint Staff	06	25%
Labourers	08	33.33%
Other Professionals	03	12.5%
Total	24	

**Chart 1: Type & number of micro-organisms isolated from cell phones of HCWs**



No fungus was isolated from either of the groups.

The antibiotic sensitivity pattern of the most commonly isolated organism from the HCWs i.e. Staphylococcus aureus showed 40% resistance against Cefoxitin (MRSA), 30% to Gentamicin & 20% to Levofloxacin; all were sensitive to Vancomycin and only 1 was sensitive to Penicillin. The CONS were sensitive to all antibiotics tested except for Pencillin (50% were resistant). Pseudomonas was sensitive to Imipenem and resistant to rest all. E. coli was resistant to Ciprofloxacin and resistant to rest of the antibiotics. According to the AST pattern E. coli & Pseudomonas were neither ESBL nor MBL producers.

All the *Staphylococcus aureus* isolates of the non-HCWs were sensitive to Vancomycin, 50% were detected as MRSA whereas 88% were resistant to Penicillin and 33.33% were resistant to Levofloxacin & Gentamicin. The rest of the isolates were CONS which were all sensitive to Vancomycin, Cefoxitin and Levofloxacin whereas 83.33% were resistant to Penicillin and 33.33% were resistant to Gentamicin.

#### 4. Discussion

In less than 20 years, mobile phones have gone from being rare and expensive pieces of equipment used primarily by business elite to pervasive low cost personal item [11]. Innovation in mobile communication technology has provided novel approaches to the delivery of healthcare and improvements in the speed and quality of routine medical communication. But at the same time bacterial contamination of mobile communication devices (MCDs) could be an important issue affecting the implementation of effective infection control measures and might have an impact on efforts to reduce cross contamination [12].

In our study the use of mobile phones by health care workers not only demonstrated a high contamination rate with bacteria but also more importantly contamination with drug resistant pathogens. Rate of contamination of the cell phones of HCWs was 30% (15/50) in our study. We found 66.66% *S. aureus*, of which 40% were MRSA and rest were MSSA; 26.66% MCONS, 6.66% with *E.coli* and *Pseudomonas* spp. together.

The rate of contamination of cell phones of Non-HCWs at our place was 48% (24/50) with 75% *Staphylococcus aureus* (of which 50% were MRSA) and 25% CONS (all were Methicillin Sensitive) as compared to a study by Kiran Chawla et al [1] which reported equal percentage of positivity (92.5%) from the HCWs' as well as non-HCWs' cell phones.

In a study by RRW Brady et al [13] reported a positivity of 96.1% growth of bacteria on cell phones, of these 14.3% of bacteria are known to cause nosocomial infections.

Bacterial contamination rate of 94.5% among the hospital staff cell phones was reported in a study by Fatma Ulger et al [14].

In a study carried out by Gholamreza Sepheri et al [15] in three teaching hospitals in Kerman, Iran reported 32% of mobile phones and 39.3% of dominant hands having bacterial contamination and *Staphylococcus epidermidis* was the most commonly cultured organism from all sites.

A study from Barbados by Ramesh J. et al [16] reported 45% of positivity and of these 15% are gram negative pathogens.

A study carried out by Jeske HC et al [17] in department of Anaesthesia 40 anaesthetists working in the operating room were asked to use their personal in-hospital mobile phones and fixed phones for a short phone call following disinfection. After use of the cell phones, bacterial contamination of the physicians' hands was 38/40 in former and 33/40 in later cases.

Ekkrakene T et al [11] reports isolation of variety of pathogenic microorganisms from the public mobile phones along Benin-sapele Express Way, Nigeria and studied the factors that affect the total bacterial count.

In one of the studies by Brady RRW et al on hospital bed-control handsets 95.7% demonstrated at least one bacterial species, 30% grew 2 and 12.9% grew 3 or more bacterial species [18].

All the above studies provide substantial evidence to prove the potential role of cell phones as vectors to nosocomial infection.

With so many studies pointing finger towards the cell phones as culprits for spreading infection, the manufacturers of cell phones seem to have become aware and are developing ways to overcome this problem. An interesting new patent was published on MAD4Mobile phones [19] about environment friendly mobile phones made from bamboo with nanotech self cleaning coating. The phone would have a bamboo, pretreated with gamma rays making it more durable and removing any bacteria, moisture, debris and contamination and coated with nano particles such as titanium dioxide, silver or zinc dioxide with sterilizing, deodorizing, antifouling and self-cleaning facilities.

Hand held Bio Sweeper decontamination UV device has been developed which is lethal to bacteria, spore including Anthrax reports Thomas Net Industrial News Room [20] on November 6, 2001. It can be easily moved in side-to-side and up-down motions over perceived or known contaminated objects whether they are fixed or mobile.

However, simple cleaning using 70% isopropyl alcohol may decrease bacterial load. [7]

#### 5. Conclusion

Though the rate of cell phone contamination is lower at our place as compared to the studies elsewhere but then it does not rule out the potential of the phones in spreading infections in hospital set-up as well as in the community. Thus to prevent the spread of potential pathogens through mobile phones, training of the HCWs about strict infection control practices, hand hygiene, environmental disinfection, routine decontamination of mobile phones with alcohol and discouraging sharing of phones between HCWs & Non-HCWs, should be done to prevent the spread of infection in hospital settings.

#### 6. References

- [1] Chawla K, Mukhopadhyay C, Gurung B, Bhate P and Bairy I. Bacterial 'Cell' Phones: Do cell phones carry potential pathogens? An ICMR short term studentship project from Kasturba Medical College, Manipal, Karnataka. Online J Health Allied Scs. 2009; 8(1)
- [2] Bernard L, Kereveur A, Durand D, Gonot J, Goldstein F, Mainardi JL, Acar J and Carlet J. Bacterial contamination of hospital physicians' stethoscopes. Infect Control Hosp Epidemiol 1999; 20: 626-628.
- [3] Baruah J. Blood pressure cuffs as a potential fomite for transmission of pathogenic micro-organisms: A prospective study in a university teaching hospital. BJ Infect Control. 2008 9 (4): 19-21.
- [4] Sorin M, Sorana SM, Mariano N, Urban C, Combest A and Rahal JJ. Nosocomial transmission of imipenem-resistant *Pseudomonas aeruginosa* following bronchoscopy associated with improper connection to the STERIS SYESTEM 1 PROCESSOR. Infect Control Hosp Epidemiol. 2001; 22:409-413.

- [5] Panhotra BR, Saxena AK and Abdulrahman S. Contamination of patients' files in intensive care units: An indication of strict hand washing after entering case notes. *AJIC*. 2005; 33(7): 398-401.
- [6] Bhatt GK, Singhal L, Philip A and Jose T. Writing pens as fomites in hospitals. *IJMM*. 2009; 27(1): 84-85.
- [7] Neely AN & Sittig DF. Basic microbiologic and infection control information control to reduce the potential transmission of pathogens to patients via computer hardware. *JAMIA*. 2002; 9(5):500-508.
- [8] Wendt C, Wiesenhal B, Dietz E and Ruden H. Survival of vancomycin-resistant and vancomycin-susceptible Enterococci on dry surfaces. *JCM*. 1998; 36 (12)3734-3736.
- [9] Winn W, Stephen A, William J, Koneman E, Procop G, Schreckenberger P, Woods G. *Koneman's Color Atlas and Textbook of Diagnostic Microbiology*. 6th ed. Lippincott Williams & Wilkins.
- [10] Performance Standards for Antimicrobial Susceptibility Testing; Twenty Second Informational Supplement. 2012; M100-S22; 32(3).
- [11] Ekkrakene T and C.L. Igeleke. Microorganisms associated with Public Mobile Phones along Benin-sapele Express Way, Benin City, Edo, State of Nigeria. *J Applied Scs. Research*, 3(12): 2009-2012, 2007.
- [12] Brady RRW, Verran J, Damani NN and Gibb AP. Review of mobile communication devices as potential reservoirs of nosocomial pathogens. *J Hosp Infect*. 2008; 7(1): 295-300.
- [13] Brady RRW, Wasson A, Stirling I, Mcallister C and Damani NN. Is your phone bugged? The incidence of pathogenic bacteria on healthcare personnel's mobile phones. *J Hosp Infect*. 2006; 62: 123-5.
- [14] Ulger F, Esen S, Dilek A, Yanik K, Gunaydin M and Leblebicioglu H. Are we aware how contaminated our mobile phones with nosocomial pathogens? <http://www.ann-clinicmicrob.com/content/8/1/7>.
- [15] Sepheri G, Talegizadeh N, Mirzazadeh A, Mir-shehari TR and Sepheri E. Bacterial contamination and resistance to commonly used anti-microbials of healthcare workers' mobile phones in teaching hospitals, Kerman, Iran. *Am J Applied Scs*. 6 (5):806-810, 2009.
- [16] Ramesh J, Carter AO, Campbell MH, Gibbons N, Powlett C, Moseley H Sr, Lewis D and Carter T. Use of mobile phones by medical staff at Queen Elizabeth Hospital, Barbados: evidence for both benefit and harm. *J Hosp Infect*. 2008 70 (2): 160-5.
- [17] Jeske HC, Tiefenthaler W, Hohlrieder M, Hinterberger G and Benzer A. Bacterial contamination of anaesthetists' hands by personal mobile phone and fixed phone use in operating theatre. *Anaesthesia*: 2007 62 (9): 904-906.
- [18] Brady RRW, Kalima P, Damani NN, Wilson RG and Dunlop MG. Bacterial contamination of hospital bed-control handsets in a surgical setting; a potential marker of contamination of the healthcare environment. *Ann RCS England*. 2007 (89): 656-660.
- [19] Altoft P. Bamboo phone with nanotech self-cleaning coating. *MAD4Mobile Phones* (News story). <http://www.mad4mobilephones.com/bamboo-phone/871>.
- [20] New Hand Held B sweeper – UV device cleans surfaces of infectious bacteria, and spores including Anthrax. (Archive News story) November 6, 2001. Thomas Net Industrial News Room. <http://www.news.thomasnet.com>
- [21] Rutala WA. APIC guideline for selection and use of disinfectants. 1994, 1995 and 1996 APIC Guidelines Committee. Association for professionals in infection control and epidemiology. *Inc. Am. J. Infect. Control*, 1996; 24: 313-342.