



Microbial isolates associated with mobile phones of healthcare providers in a tertiary care hospital

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Abstract:

Objectives: This study was conducted to determine microbial contamination of mobile phones used by healthcare providers in a tertiary care hospital in Thrissur, Kerala, India and isolate the common microbial contaminants found therein. **Materials & Methods:** A total of 100 samples were collected from the mobile phones of medical college hospital staff using sterile cotton swabs. Isolation and identification of bacterial species was done as per the Clinical and Laboratory Standards Institutes (CLSI) guidelines. **Results:** Out of 100 samples, 26 samples did not show any isolates. Remaining 74 samples showed mixed growth. In that, 51 (68.91%) were Gram positive cocci (GPC- 29.41% were *Staphylococcus aureus*, 50.98% were CONS, 3.92% were Streptococcus, and 15.69% of *Micrococcus*), 12 (16.22%) were Gram negative bacilli (GNB- 50% comprised *Escherichia coli* and 16.67% of *Klebsiella spp.*, 25% *Pseudomonas* and 8.33% of *Acinetobacter*), 6 (8.11%) were Gram positive bacilli (GPB) and remaining 5 (6.76%) were fungal isolates (40% of *Candida albicans* and 60% of non-albicans *Candida*). Further evaluation of MRSA and MSSA was carried out on *Staphylococcus aureus* and 20% of isolates comprised of MRSA and 80% of MSSA and furthermore 25% of CONS comprised of MR CONS. About 93% of the users had never cleaned their phones, 5% cleaned their phones using cloth occasionally and only 2% had cleaned their phones more than once in two weeks. Using dry cloth only for cleaning showed 64.86% growth & wet cloth was only 62.16%. Use of 70% isopropyl alcohol showed 18.92% growth, and a combination of wet cloth with 70% isopropyl alcohol provided most effective cleaning with growth percentage of only 9.46%. **Conclusions:** Findings indicate that mobile devices are potential vectors for transmission of infections within the hospital environment. Restricting the use of cell phones in clinical environments, hand hygiene, and instilling practices for decontamination of mobile devices could reduce the risk of transmission of potentially dangerous pathogens.

Key words: microbial, mobile phones, healthcare, decontamination of mobile

Introduction:

Asia, and in particular India¹, has one of the world's largest and fastest growing mobile networks and is one of the biggest markets for cell phone companies today. The use of mobile phones has had a tremendous impact on communication networks, connectivity and productivity the world over. However, the widespread use of small hand devices coupled with lack of personal hygiene, more so in developing nations, shall pose a serious risk of an increased potential for spread of various diseases through these new vectors. Sharing of mobiles and a practically nonexistent culture of cleaning these shared phones, certainly make them excellent reservoirs of various microbes,

which are then spread from user to user. This role of phones in the spread of nosocomial infections has been well documented before², and several research indicate that the heat generated by the mobiles, coupled with moisture inherent to the users hands creates a prime breeding ground for microbes, be it natural skin flora or pathogenic species. In an hospital environment, mobile devices are extensively used by doctors and other health care workers (HCWs) for immediate communication during emergencies, in rounds, and even in operation theatres and intensive care units etc.^{2,3} These may serve as mobile reservoirs of infection allowing the transmission of the contaminating bacteria

to many different clinical environments and patient settings.⁴ Further, sharing of cell phones between hospital staff directly facilitates the spread of potentially pathogenic bacteria within the medical community. Various objects like stethoscopes, patient files, bronchoscopes and ballpoint pens have already been reported as vectors for potentially pathogenic microorganisms from hospital staff to patients^{5, 6}. The potential of cell phones as vectors for nosocomial infection has been studied before.^{3,4} These studies reported that the most commonly found bacterial isolate was Coagulase Negative Staphylococcus(CONS) as part of normal skin flora. Potentially pathogenic bacteria found were methicillin sensitive *Staphylococcus aureus* (MSSA), coliforms, Methicillin Resistant *Staphylococcus aureus* (MRSA), *Corynebacterium spp.*, *Enterococcus faecalis*, *Clostridium perfringens*, *Klebsiella spp.*, *Enterobacter spp.*, *Pseudomonas spp.*, *Aeromonas spp.* Acinetobacter and *Stenotrophomonas maltophilia*. Our study aimed at investigating bacterial colonization of the mobile phones amongst healthcare providers, to isolate microbes commonly associated with mobile phone surfaces in our hospital staff and to additionally evaluate the frequency of cleaning of mobiles amongst the study group.

Materials and Methods:

The samples were collected from the mobile phones of 100 users between 15th December 2015 to 15th March 2016, amongst healthcare providers at Jubilee Mission Medical College and Research Institute, with at least a minimum usage of 1 month duration of the phones. Sterile cotton swab sticks were used for sampling from all areas of the phone which come most in contact with the user's hand. Each swab was immediately inoculated on nutrient agar, blood agar and MacConkey

agar (HiMedia, India) and Candida CHROM agar following standard protocols and incubated at 37°C for 24 hours. Isolation and identification of microbial species were done as per the Clinical and Laboratory Standards Institute (CLSI) guidelines. Pure isolates so obtained were then subjected to morphologic and growth characterization, Gram stain and biochemical profiling was done in accordance to standard protocols. Further, the effects of cleaning on growth using dry cloth, wet cloth, 70% isopropyl alcohol and a combination of cleaning with wet cloth and isopropyl alcohol was studied.

Results and Discussion:

Although personal hygiene is a much looked after trait amongst people in general, certain areas are often overlooked and these pose potential risks as reservoirs and transmitters of organisms, which in certain settings like hospitals, might have serious consequences if overlooked. Our investigation confirms that especially in a hospital setting, the risk of transmission of potentially pathogenic microbes is a reality, as evident by the various microbes found on the mobile phones of the subjects studied.

The findings (26 samples showed no isolates) indicate that Gram positive cocci (GPC), Gram negative bacilli (GNB), Gram positive bacilli (GPB) and fungal isolates were the most common organisms found on the mobile phones samples.

Of the GPC isolates, 29.41% were *Staphylococcus aureus*, 50.98% CONS, 3.92% Streptococcus and 15.69% Micrococcus. Among the Gram negative bacilli (GNB) isolated, 50% comprised of *Escherichia coli*, 16.67% *Klebsiella spp.*, 25% *Pseudomonas* and 8.33% *Acinetobacter spp.* Fungal isolates consisted of 40% of *Candida albicans* and 60% *non-albicans Candida*.

Table I: Showing the rate of isolation of various microbial isolates

Organism	Number	%
Gram positive cocci (GPC)	51	68.91
Gram negative bacilli (GNB)	12	16.22
Gram positive bacilli (GPB)	6	8.11
Fungal isolates	5	6.76

The presence of these microbes on the mobile phones indicate that the risk of potential transmission of possible pathogenic organisms is a clear possibility and frequent handling by many users as well as lack of personal hygiene and possibly fecal contamination of the phones, contributed to the colonization of the mobile phones. Many of these isolated species and their subtypes, especially *Staphylococcus*, enterococci etc. are known to cause illnesses ranging from mild skin problems to potentially fatal complications like pneumonia, meningitis and gram negative sepsis etc. On antibiotic resistance, further evaluation of MRSA and MSSA was carried out on *Staphylococcus aureus* and 20% of isolation comprised of MRSA and 80% of MSSA. Out of 26 isolates of Coagulase Negative *Staphylococcus* (CONS), 5 isolates (19.23%) were Methicillin resistant CONS.

Out of 74 contaminated mobile phones, it was found that 64.86% who used only dry cloth for cleaning occasionally showed growth, while the same was 62.16% for wet cloth users, only 18.92% of those using 70% isopropyl alcohol showed demonstrable growth, which further went down to 9.46% in those using a combination of wet cloth with isopropyl alcohol. This indicates that frequent disinfection using common disinfectants is better than just wiping the phone with a wet or dry cloth, and would help reduce colonization by various microbes to a great instance.

The most commonly found bacterial isolates were coagulase-negative *Staphylococcus aureus*, which been shown to cause infections. For example, *Staphylococcus epidermidis*, though a commensal of the skin, has now been generally accepted as a pathogen⁷, mainly as the most frequent cause of catheter-associated sepsis and implant infections⁸. It has also been recorded as methicillin resistant^{9,10}. Other bacteria more widely accepted as pathogenic have also been isolated from mobile phones, including many with a potential for drug resistance: methicillin-sensitive *Staphylococcus aureus* (MSSA), methicillin-resistant *Staphylococcus aureus* (MRSA), *Micrococcus spp.*, and coliforms (*Klebsiella spp.*, *Escherichia coli*; strains which can be pathogenic¹¹. Our findings corroborate the presence of resistant strains on mobiles which further could have a bearing on the spread of antibiotic resistant bacteria.

In a study in south India amongst mobiles belonging to healthcare workers, pathogens isolated included *S. aureus* (methicillin-sensitive *S.aureus*, methicillin-resistant *S.aureus*), *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and coagulase-negative staphylococci predominantly¹². Karabay et al¹³ found that most of the organisms isolated were skin flora. However, 16.7% of the samples were positive for pathogens known to be associated with nosocomial transmission, such as *Enterococci spp.*, *S. aureus*

and *K. pneumoniae*. These findings are consistent with our study as to the commonest isolates found.

In this study, the majority (74%) of devices showed contamination by three or more different bacteria, whereas Sreekanth et al¹² identified that 48% of the mobile phones they tested had two different species of bacteria on them, and just 26% had three or more, while Brady et al¹⁴ found 11.8% and 6.9% respectively, with the majority (64.7%) growing just one species. The disparity could be due to inability to predict or categorize phones depending on multiple users or not.

Our findings support that use of wet cloth with 70% isopropyl alcohol reduces the number of growth or isolates found. The literature acknowledges that the numbers of microorganisms on handheld devices, including pathogens, are reduced by cleaning with alcohol, but not totally removed. Kilic et al¹⁵ found that only 33% of mobile phones that were cleaned at least once a week with alcohol were contaminated, albeit solely with *S.epidermidis*. While Jayalakshmi et al¹⁶ established that 70% isopropyl alcohol disinfected nearly all mobile phones in their study, with a gross reduction in the number of organisms, Ramesh et al¹⁷, found that it was the act of daily cleaning, not the cleaning method used (alcohol versus dry cloth) that was significantly associated with amount of growth, corroborated by Singh et al¹⁸.

This questions the efficiency of alcohol as a cleaning agent for mobile phones and indicates that further investigation is needed into the optimal disinfection method for these devices.

Conclusions:

The findings from this study suggest that mobile phones are contaminated with significant numbers of microbes, which may be normal flora with a potential to cause untoward infections at times or

overtly pathogenic microbes capable of causing localized or systemic infections. Overall, it can be said that mobile phones are a potential source of microbial transmission and in a hospital setting already overburdened with a plethora of hospital acquired infections affecting patient outcomes, this multitude of microbial reservoirs could further compromise patient as well as hospital care givers safety. The Hospital Infection Control committee can help reduce mortality and morbidity related to infection control by implementing preventive strategies which include basic hygiene and sanitation practices for healthcare workers, be it at their work desks or in the use of personal devices such as mobile phones.

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