

Short Communication: Contamination of cell phones by pathogenic microorganisms: Comparison between hospital staff and college students

PURNIMA R. CHITLANGE[▼]

Department of Microbiology, Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola-444001, Maharashtra, India. Tel.: +91-724-2414049, 2415480; Fax: +91-724-2415650; [▼]email: successpunamchitlange@gmail.com

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Abstract. Chitlange PR. 2014. Contamination of cell phones by pathogenic microorganisms: Comparison between hospital staff and college students. *Nusantara Bioscience* 6: 203-206. Cell phone (CP) is a long range portable electronic device. The cell phone is constantly exposed to arrays of micro organisms, making it a harbor and breeding ground for microbes especially those associated with skin. The adult human is covered with approximately 2m² of skin with area supporting about 10⁶ bacteria. To check whether the cell phone act as a vector for transmission of various pathogens, a potential study was carried out in Microbiology Department of Shri Radhakisan Laxminarayan Toshniwal College of Science, Akola, Maharashtra, India. Total 20 cell samples were screened. Two parameters were considered: College students and hospital staff. The isolated bacteria *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas* sp., *Bacillus subtilis*, *Aerobacter aerogenes*, *Salmonella*, *Shigella*, *Streptococci*, *P. vulgaris* were identified on the basis of morphological and cultural characteristics. The main aim of present study was to check the contamination by bacterial pathogens on cell phones and also to check role of cell phone for transmission of pathogens from person to person or not.

Key words: Bacteria, cell phones, pathogens, transmission

INTRODUCTION

Now a day's use of Cell phones becomes very important devise for communication all over the world.. Being luxurious and easy in handling everybody it is used by college students' doctors and hospital workers for emergency purpose or for fast communications. While using cell phones there are chances of contaminations attack on cell phone and may be transfer from person to person. Similarly, distribution of cell phones from one person to another person especially workers working in hospitals make possible to spread of pathogenic organisms. The ability of the cell phones as mediator to nosocomial infection has been studied (Rafferty and Pancoast 1984; Brady et al. 2006; 2007).

Due to basic need of cell phones use of cell phones may transfer from person to person may be from unhygienic person to another person. Hence steady handling of the phone by different users exposes it to collection of microorganisms. Because of different person handling makes a good carrier for microbes, particularly those associated with the skin resulting in the spread of different microorganisms from person to person. There are most chances of transmission of pathogenic organisms especially from hospital workers because number of patient have available with different disease. For the communication system cell telecommunication was established in 1982 in Europe. In India in 1995 the cell phone was first used but now 287 million cell phones are using (Kapdi et al. 2008).

Research has shown that the cell phone could constitute a major health hazard. Microbiologists say that the

combination of constant handling and the heat generated by the phones creates a prime breeding ground for all sorts of microorganisms that are normally found on our skin (Brady et al. 2006). The adult human skin has surface area of approximately 2m² which is constantly in contact with environmental microorganism and become readily colonized by microbial species of about 10¹² bacteria (Mackowiak 1982). Now a day's increased in use of cell phones by HCWs in OT, ICU, CCU and burn wards may have more serious hygiene consequences. Because unlike fixed phones, cell phones are often used in these areas close to the patients and these patients are more vulnerable to hospital acquired infection tempted us to investigate possibility of hospital acquired infection due to usage of cell phone (Neely et al. 1999; Trick et al. 2002; Jeske et al. 2007).

The main aim of present work was to check the contamination of bacterial pathogens on cell phone. Moreover, to evaluate whether cell phone play a major role in transmission of pathogenic bacteria from person to person or not.

Materials and methods

Collection of sample and isolation of pathogenic bacteria

Total 20 cell phone samples were collected from the hospital staff and college going students of Akola city, Maharashtra, India and screened for the presence of bacterial pathogens. The total sample collection included into two groups, i.e. (i) College going students and (ii) Hospital staff. A total 10 samples were collected from each

group. The hospital staff comprising of doctors and health care workers and college going students were screened. The swab samples from cell phones were collected in sterile vials using sterilized cotton bud dipped in saline water (0.9%). Before taking swab samples, both hands were thoroughly washed with soap and disinfected with alcohol. The sterilized cotton bud was rotated on the overall surface area of the cell phone. The cotton bud swab after swabbing the cell phone was again kept in the respective sterile vials. The cotton swabs were transferred immediately in to the lab to prevent dryness. The samples were inoculated on sterilized nutrient agar plates and the plates were incubated at 37⁰ C for 24 hours for further growth.

Purification and identification of isolated pathogenic bacteria

Different bacterial colonies were grown on nutrient agar and were further purified on different selective medium such as Mac Conkeys agar, milk agar, eosin methylene blue agar, mannitol salt agar, deoxy cholate agar, azide blood agar, *Pseudomonas* agar, Baird Parker agar for purification of different bacteria. The pure cultures were maintained by streaking on nutrient agar slants. Isolated microorganisms were identified on the basis of morphological and cultural characteristics like morphology of colony, color of colony, colony characters, Gram staining, Sporulation, Motility, biochemical tests, catalase test, oxidase test and sugar fermentation.

Table 1. List of selective media used for isolation of bacterial pathogens

Test organism	Selective media
<i>Staphylococcus aureus</i>	Milk agar
<i>Escherichia coli</i>	Eosine methylene blue agar (EMB)
<i>Pseudomonas</i>	<i>Pseudomonas</i> agar
<i>Shigella</i>	Deoxycholate agar
<i>Streptococci</i>	Azide blood agar
<i>Staphylococcus aureus</i>	Mannitol salt agar (MSA)
<i>Bacillus subtilis</i>	Nutrient agar
<i>Salmonella</i>	Blair Bismuth Sulphite agar
<i>Aerobacter aerogenes</i>	Eosine methylene blue agar (EMB)

Results and Discussion

All over world microbiological standards in hygiene are required for a healthy living. It is not uncommon however to observe shifts in hygiene practices that wander from standards in developing and developed country. This search confirms such deviation, as arrays of microbes are found associated with public cell phones. Also important in the investigation are the factors of location and possible number of users. A total 20 samples were collected from the cell phones of the volunteers from the college going students and hospital staff. The isolated bacteria from cell phone of hospital staff and college students were identified with the help of Bergey's Manual of determinative bacteriology (Bergey and Breed 1957). We isolated different type of bacterial pathogens such as *Escherichia coli*, *Pseudomonas* sp., *Staphylococcus aureus*, *Bacillus subtilis*, *Streptococci* sp., *Salmonella* sp., *Aerobacter aerogenes* and *Shigella* sp. (Figure 1).

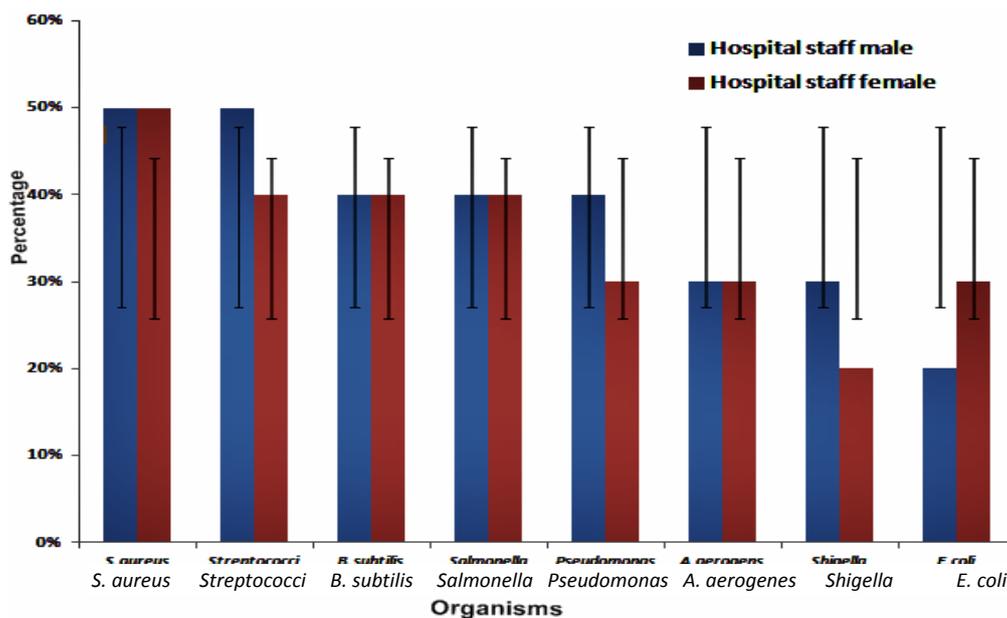


Figure 1. Frequency of isolated bacteria from cell phone samples collected from Hospital staff. (Where, HSM = Hospital staff male, HSF = Hospital staff female).

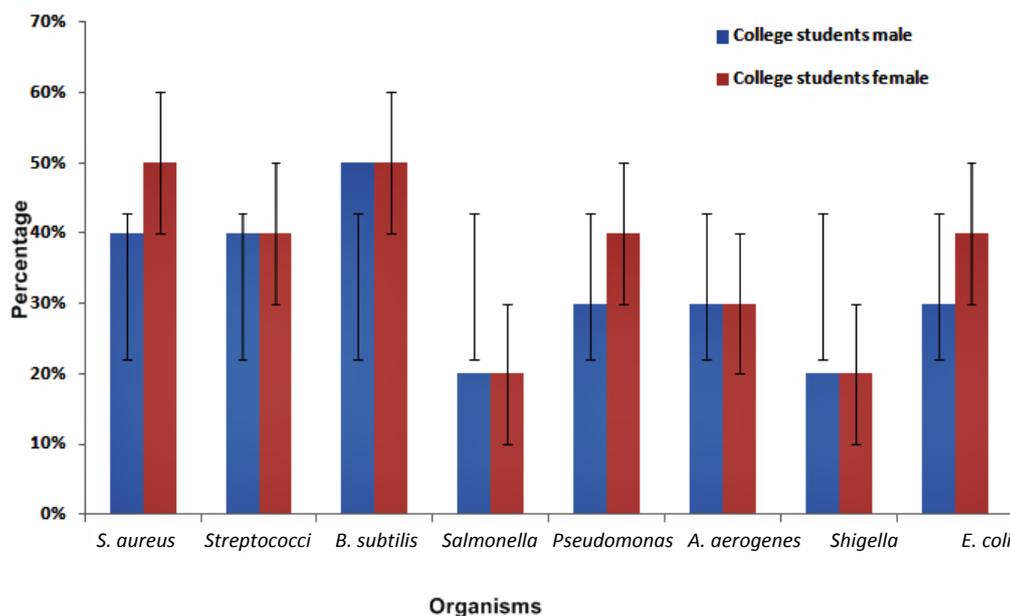


Figure 2. Frequency of isolated bacteria from cell phone samples collected from college going students (Where, CGM=College going male, CGF= College going female).

While screening of 20 cell samples we found that the diversity of pathogenic bacteria like *S. aureus*, *Streptococci* sp., *B. subtilis*, *E. coli* and *Shigella* species from both hospital staff and college going students (Figure 1, 2). The most common dominating bacterial species was *Staphylococcus aureus* (100%) followed by *Streptococci* sp. (90%), *B. subtilis* (80%) and the least occurrence was *Shigella* species (50%) and *E. coli* (40%) among all the hospital staff and college going student samples (Figure 1, 2). We found that the percentage of pathogen transfer was more in samples collected from hospital staff as compared to samples collected from college going students. It may be due to frequently and suddenly handling of cell phones or due to emergency call, because when hospital staff is working at that time they have been associated with pathogenic organism. Isolated bacterial pathogens were identified on the basis of morphological and biochemical test such as color of colony, colony characteristics, Gram staining, sporulation, motility and biochemical tests, like catalase test, oxidase test and sugar fermentation respectively.

For further confirmation we performed the biochemical test for bacteria isolated from samples of cell phone of hospital staff and college going students we found that some were Gram positive such as *S. aureus*, *Streptococci* sp., *B. subtilis* and *A. aerogenes* and some were Gram negative like *Salmonella* sp., *Pseudomonas* sp., *Shigella* sp. and *E. coli* (Table 2 and 3). Similarly some of them were sporulating such as *B. subtilis* and *Pseudomonas* sp. and some of them were non-sporulating like *S. aureus*, *Streptococci* sp., *A. aerogenes*, *Salmonella* sp., *Shigella* sp. and *E. coli*. Moreover, we also performed the motility test of isolated organisms we found that bacteria such as *B.*

subtilis, *Salmonella* sp and *E. coli* were highly motile and some were non-motile such as *Pseudomonas* sp., *S. aureus*, *Streptococci* sp., *A. aerogenes*, *Shigella* species.

From the above results we assumed that the pathogenesis of organism also depends on the environment where we are using cell phones. We found maximum pathogens in cell phone samples of hospital staff as compared to cell phone samples of college going students. The bacterial isolates were maximum in samples of cell phones collected from female of hospital staff as compared to college going female.

The hospital environment plays a significant role in the transmission of microorganisms associated with hospital acquired infections. Microorganisms can be transferred from person to person or from inanimate objects (such as stethoscopes, bronchoscopes, pagers, ballpoint pens, patient hospital charts, computer keyboards, cell phones and fixed telephones) to hand and vice versa (Rafferty and Pancoast 1984; Marinella 1998; Bures et al. 2000; Singh et al. 2002; Brady 2007; Goldblatt et al. 2007). In present study, total 20 cell samples were collected 10 from Hospital staff and 10 from College going students. In case of Hospital staff we encounter the Bacterial Pathogens as *S. aureus*, *Streptococci*, *B. subtilis*, *Salmonella*, *Pseudomonas*, *A. aerogenes*, *Shigella* and *E. coli*. The maximum percentage (100%) was found of *S. aureus* followed by *Shigella* and *E. coli* with 50% in case of Hospital staff samples. Moreover, in samples of the College going students we found that *S. aureus*, *Streptococci*, *B. subtilis*, *Salmonella*, *Pseudomonas*, *A. aerogenes*, *Shigella* and *E. coli*. Similarly, the *S. aureus* percentage was found up to 90%, whereas the maximum percentage was found of *B. subtilis* that is 100% followed

by *Shigella* and *Salmonella* with 40%. Moreover, we also found that in case of Hospital staff cell phones of female health care workers were less contaminated by pathogens as compared to male health care workers, but the percentage of *E. coli* being the highest in female health care workers. Whereas in case of college going students the female cell phones showed maximum contamination of *S. aureus*, *Pseudomonas* and *E. coli* as compared to male students.

Goldblatt et al. (2007) reported that the microorganisms can be transferred from one person to another person or from one dead object to another one. In present study we found the same bacterial diversity and results in that the pathogens were maximum in samples collected from hospital staff as compared to samples collected from college going students. It might be due to the environment of hospital where all instruments and tools act as the breeding ground for pathogens. It is reported that average cell phone is grimey than either a toilet seat or the bottom of your shoe. These results suggested that close contact objects that were contaminated could serve as best way of bacteria which could be easily transmitted from the cell phone to the HCWs' hands. During every phone call the cell phones come into close contact with strongly contaminated human body areas with hands to hands and hands to other areas (mouth, nose, ears) due to that cell phone becomes way for transmission of pathogens.

In conclusion, from the above results and discussion it can be concluded that the cell phone plays an important role in transmission of pathogens from one person to another person. Moreover, cell phone is one of the intermediate agents for transmission of pathogens; we suggest that we should wipe our cell by alcohol or dettol once in a day to avoid infection of pathogens. Similarly we should avoid the use of cell phone in the dirty area or dusty environment to avoid pathogen sticking especially in hospitals unless and until it is not required. One should avoid unnecessary use of cell phones in hospital environment. Hygienic conditions should be maintained in the hospital to avoid nosocomial infection. We should avoid sharing of cell phones with children because as their immunity power is less they are more prone to such infections. The health care workers and students should

follow the practice of Sanitization and hand washing strictly to avoid infection by pathogens.

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