

Microbial Contamination of Mobile Phones of Healthcare Workers in Teaching Hospitals, West Libya

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ABSTRACT

Mobile phones are used worldwide by health care workers (HCWs) in hospitals during working time without restrictions, regardless of their unknown microbial load. This study was conducted in order to determine the **bacterial** contamination level of the mobile phones used by health care workers (HCWs) at Sabratha Teaching Hospital and National Cancer Institute, Sabratha, Libya. A total of 100 volunteers from HCWs (35 Doctors, 15 Nurses, 15 Lab technician and 35 Students) were included in this study. The results revealed that 74% of the mobile phones and hands of HCWs were microbial contaminated. The Lab technician and Technology student's phones and hands had the highest microbial load contamination (87%, 80% respectively). *Staphylococcus spp*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa* and *Escherichia coli* were the predominant contaminated bacteria. *Candida albican* was also isolated from contaminated phones of HCWs during this study. ***Candida albican*** is one of the common hospital infection microorganism which serves as a vehicle for the spread of nosocomial pathogens in hospitals. Our study concluded that these contaminated phones can play a potential role in the spread of hospital infection bacteria in the community, since the same phones are used inside and outside of hospitals. To prevent the potential spread of infections through mobile phones, training of the health care personnel about strict infection control practices, hand hygiene, environmental disinfection and routine decontamination of mobile phones with alcohol should be advocated to prevent the spread of infection in the hospital settings.

Key words: Mobile phone, HealthCare Workers, Hospital, Bacteria.

INTRODUCTION

Mobile phone is very important to human life as it facilitates the person needs and is vital for communication services worldwide. Mobile phones are used by every one of the community from young to old personnel. Although, the mobile phone which is handled by a large number of people increase the possibility of acting as environmental vehicle for the transmission of potential pathogenic microorganisms (i.e., bacteria and fungi). So, the infected mobile phone is identified as potential public health hazard as pathogen spread by circulating them among community people. Immunocompromised person stand the risk of acquiring opportunistic infection, through handling of contaminated mobile phones. Opportunistic infection can occur when immune system is not function properly so bacteria and fungi are usually harmful and cause diseases, in particular nosocomial infections.

Nosocomial infections caused by multi-drug resistant gram-positive organisms such as *Staphylococcus aureus* and *Enterococcal species* are a growing problem in many health care institutions. Nosocomial infections increase day by day and such infections cause a significant rate of mortality and morbidity (1-4).

Handwashing is recognized as a basic measure for preventing nosocomial infections (5). However, compliance with handwashing in hospital environments is generally less than 50% (6). The role of the hands in disease transmission and the importance of hand hygiene in controlling

infection in hospitals is well established (7-10). Handwashing has been identified as the single most important means of preventing the spread of infection (11,12) and if poorly or improperly implemented, can lead to foodborne illness outbreaks (9,13,14) and hand-transmitted nosocomial infections (7,8,11,12,15).

Mobilephones have become an indispensable part of our lives. In the healthcare setting, they are essential for quick and easy access to laboratory and imaging results, for consultations, and sometimes for life-threatening emergencies (16). Mobile phones used by patients and their visitors were twice as likely to contain potentially dangerous bacteria as those of health-care workers, HCWs (17). One in six mobile phones in Britain is contaminated with faecal matter, according to new research released ahead of Global Handwashing Day. Experts say the most likely reason for the potentially harmful bacteria festering on so many tools is people failing to wash their hands properly with soap after going to the toilet or after using mobile phones (17).

Although 95% of people said they washed their hands with soap where possible, 92% of phones and 82% of hands had bacteria on them. Worryingly, 16% of hands and 16% of phones were found to harbour *E. coli*, bacteria of a faecal origin. Harmful *Escherichia coli* associated with stomach upsets and has been implicated in serious cases of food poisoning (17). Faecal bacteria

can survive on hands and surfaces for hours at a time, especially in warmer temperatures away from sunlight; it is easily transferred by touch to door handles, food and even mobile phones. From there, the germs can be picked up by other people. Every year, 3.5m children under the age of five are killed by pneumonia and diarrhoeal diseases and the simple action of washing hands with soap is one of the most effective ways of preventing these illnesses. In developed countries, handwashing with soap helps to prevent the spread of viral infections, such as norovirus, rotavirus and influenza(17,18).

Since there is no data on the risk of contamination of personal mobile phones in HCWs in our hospitals, so this study was undertaken to investigate the potential role of personal mobile phone in the transmission of nosocomial pathogens and resistance to commonly used antimicrobials. Mobile phones have become an indispensable part of our lives including healthcare centers especially for life-threatening emergencies. The use of mobile phones by HCWs may create serious hygiene consequences and may serve as vectors for the nosocomial transmission of microorganisms and patients are more vulnerable to hospital acquired infection.

The Aim: This study was undertaken to investigate the potential role of personal contaminated mobile phones of the HCWs in the transmission of nosocomial pathogens.

MATERIALS AND METHODS

Survey: The study was conducted in April 2010 in Sabratha Teaching Hospital (STH) and Sabratha National Cancer Institute. Healthcare workers (HCWs) volunteers from both institutions were used to investigate the bacterial contamination of mobile phones.

Samples Collection: 100 HCWs were participated in this study. HCWs were divided into four different groups (35 physicians (Doctors), 15 nurses, 15 lab technician and 35 students). Two sterile cotton swaps from each participant in each group (one from the dominant hand and another from the mobile phone) were collected and immediately transferred to the microbiology laboratory at STH to apply all microbiological examinations for the different collected samples in order to isolate and identify contaminated organisms.

METHOD

Swabbing: For each HCW, a sterile swab moistened with sterile water was rotated over the surface of both sides of his/her phone, and a second swab was taken from the dominant hand of HCWs. Both swabs were immediately transferred to a tube containing 5ml of appropriate broth media and incubated at 37°C for 18 hours. At the end of incubation period a loop-full of broth media were transmitted to appropriate agar plates and incubated at 37°C for 48 hrs.

Inoculation in culture media: Streaking and swabbing were done with sterile water using sterile loop and swab and inoculated onto Mannitol Salt Agar; MSA (Oxoid England) and Muller Hinton Agar; MH (Oxoid England) to obtain bacterial isolation after 48 hrs. incubation period at 37°C. While Sabouraud's Dextrose Agar; SDA (Oxoid England) was used for fungal isolation for one week at 28°C.

Examination of culture media: Cultures in solid media were visually inspected and microscopically examined for growth rate and colony characteristics.

Sub-culturing: Different colonies were sub-cultured on MSA and MHA and incubated similarly as before.

Confirmed identification: Coagulase test for gram positive bacteria, oxidase test and API 20E system for gram negative bacteria were used.

Statistical analysis:

Statistical analysis was carried out by using SPSS for windows version 14 program. The significance level (0.05 parametric) was used to indicate

statistical significance. The one way ANOVA was used to define the percentage of contamination of mobiles and dominant hand considered as statistical significant

RESULTS

The HCWs aged from 21-45 with the mean age of 33 (SD 6.6) years. About 55% of them were woman. The results show frequency of microbial contamination of both hands and mobile phones in all the four groups by 74 %.

The data analysis of contaminated mobile phones (figure 1) showed that hands of lab technician and students were contaminated by 86% and 80% respectively. On the other hand 70% of microbial contamination was observed on nurse's hands, and 61% exhibited on hands of physicians.

Out of all the study groups, mobiles of both Lab technician Nurses and physicians groups showed highest microbial contamination 45%,27% and 17% respectively.

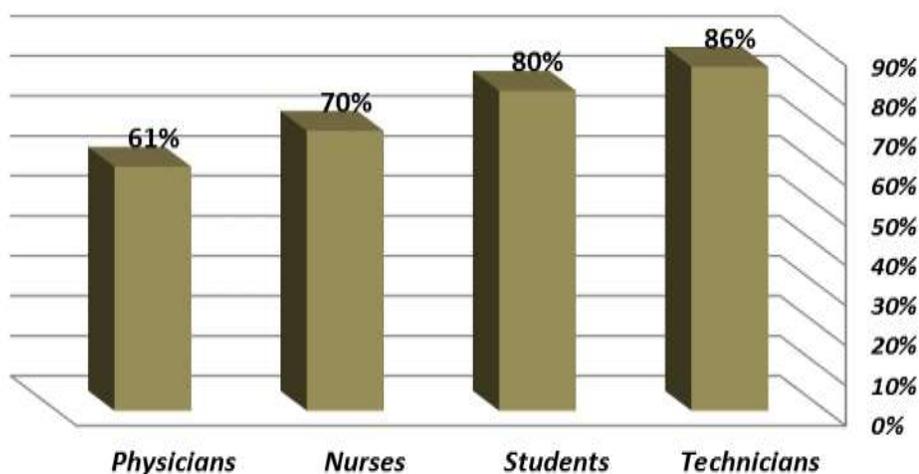


Figure 1: Percentage of microbial contamination of Hands by mobile phones in different groups of HCWs.

Table 1. Percentage of microbial contamination of HCWs

| Object | Percentage (%) of microbial contamination | | | |
|-----------------------|---|----------|--------|------------|
| | Participants of HCWs groups | | | |
| Object | Technicians | Students | Nurses | Physicians |
| Mobile phones | 45% | 11% | 27% | 17% |
| Hands | 21% | 32% | 13% | 34% |
| Mobile phones & Hands | 20 % | 37% | 33% | 10% |
| Total | 86% | 80% | 70% | 61% |

As shown in table 1, 37% of microbial contamination were observed on hands and mobiles of Students. 27% and 13% of microbial contamination were observed on hands and mobiles of nurses respectively. By contrast hands and mobiles of students showed 11% and 32% of microbial contamination respectively.

Microbiological methods which were adopted in this study indicated that various species of bacteria and fungi have been

isolated from mobile phones and hands of HCWs. The genera of isolated bacteria are shown in table 2. Table 2 shows the different types of isolated and identified micro-organisms from mobile phones and hands of HCWs. Such difference in HCWs was statistically significant ($p = 0.05$).

The identified gram positive bacteria were *Staphylococcus aureus*, *Staphylococcus epidermidis*, and spore-forming bacteria such as *Bacillus*

subtiles. Identified gram negative bacteria were *Klebscillapneumonia*, *Pseudomonas aeruginosa*, and *Escherichia coli*. Fungus which isolated from HCWs was *candida albicans*. Bacteria which isolated from respectively.

different HCWs and showed high occurrence were *Staphylococcus epidermidis*, *Bacillus subtilis* and *Staphylococcus aureus* with 32%, 29% and 18%.

Table 2. Laboratory isolated and identified microorganisms from mobile phones and hands of HCWs.

| Types of organisms | Percentage (%) of isolated organisms | | |
|-----------------------------------|--------------------------------------|-------|------------|
| | Mobile phones | Hands | Total |
| <i>Staphylococcus epidermidis</i> | 12% | 20% | 32% |
| <i>Bacillus subtilis</i> | 10% | 19% | 29% |
| <i>Staphylococcus aureus</i> | 8% | 10% | 18% |
| <i>Klebscilla pneumonia</i> | 3% | 6% | 9% |
| <i>Pseudomonasaeruginosa</i> | 2% | 3% | 5% |
| <i>Candida albicans</i> | 1% | 3% | 4% |
| <i>Escherichia coil</i> | 1% | 2% | 3% |

The occurrence of some species such as *Klebscillapneumonia*, *Pseudomonas aeruginosa* and *Escherichia coil* were somewhat negligible and in a limited manner of prevalence with some percentage of 9%, 5% and 3% respectively. Moreover, the only predominant fungal species isolated was *Candida albicans* in very low percentage (4%).

DISCUSSION

From the present investigation, it was clearly observed that there is a positive correlation between mobile phones and hands in microorganisms that were found, regardless of the species found. Mobile phones are more contaminated with pathogenic bacteria because they involve the use of large HCWs which means more handling more frequent use leading to more contamination. The bacteria isolated belong to Enterobacteriaceae family which is more frequency found in the air (air-

borne) and was found also in large quantity in faces. This reflects that faecal pollution appears as a result of poor hygienic attitude in the HCWs. Moreover, the genera of Enterobacteriaceae are usually hazardous such as *E. coli* and *Salmonella typhi* that are pathogenic to human and animals. Also from this investigation, we have reached to the point that mobile phone gives a positive appearance of potentially pathogenic bacteria (10,11,), which also indicated lack of hygienic attitude.

Other investigations revealed that, serious hygiene consequences had been occurred due to the use of mobile phones by HCWs in the operating rooms close to the patients in critical places in the hospital for example intensive care unit, burn wards and operative rooms as a result intensive care unit patients and burned patients are more vulnerable to infectious diseases, so the risk of

transmission of organisms associated with nosocomial infections will be increased in these patients (12,13).

Seeking to provide better communication, nowadays nearly 100% of HCWs owns and use mobile phones believing that they can provide better communication and good health care facilities to patients. In fact uncontrolled use of mobile phones by HCWs increase the spread of nosocomial infections, therefore implementation of effective preventive strategies for well-practiced infection control plan is an essential need to overcome environmental contamination, and the simplest way to decrease the bacterial load is the use of 70% isopropyl alcohol to clean hands and mobile phones (13,14).

CONCLUSION

The results suggest that mobile phones may be contaminated especially with bacteria and enteric microbes and may serve as a source of infection. Personal hygiene to reduce the risk of infection is recommended.

RECOMMENDATIONS

Therefore, a recommendation should be pointed out such as awareness of people is how to handle mobile phones emphasizing to prevent the potential spread of infections through mobile phones, training of the health care personnel about strict infection control practices, hand hygiene, environmental disinfection and routine decontamination of mobile phones with alcohol should be advocate.

ed to prevent the spread of infection in the hospital settings.

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