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Frequency Survey of Bacterial Contamination of Mobile Cell Phones in General Population in Tehran, Iran

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Abstract

Background: Mobile smart phones have become increasingly integrated into the daily lives of individuals in society. Recent studies indicated the considerable role of these devices as reservoirs for various micro-organisms. The objective of this study was to assess the prevalence of microbiological contamination of mobile phones in general population.**Materials and Methods:** This cross-sectional study included a large sample of mobile phones of general population Tehran in 2015. Samples for culture were collected from mobile phones and transported for microbiological identification based on standard laboratory methods. **Results:** Bacteriological analysis revealed that in total of 5220 sample retrieved, 5180 (98.9%) mobile phone devices were contaminated with bacteria. The most common microorganisms that were isolated include: *Staphylococcus epidermidis* (63.9), *Escherichia coli* (12.3%) and S*taphylococcus aureus* (11.4%). **Conclusion:** The prevalence of mobile phone contamination is high in general population in Tehran. Although most of the isolated organisms seemed to be non-pathogenic, their colonization may endanger certain populations particularly in health care settings. **[GMJ.2016;5(2):70-74]**

Keywords: Mobile Phones; Hygiene; Contamination

Introduction

The global utilization of mobile phones has been accelerated in recent years. Nowadays, this technology has enormously affected different aspects of human life by its numerous applications and accessories [1,2]. Mobile phone due to its nature is easily accessible and constantly handled by owners in all places such as houses, hospitals, toilets, public stations, etc. Such environments have very high density of micro-organisms many of which are potentially pathogenic bacteria, and mobile phones could present as a major vehicle

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for transmission of these micro-organisms in the environment [3].

Previous studies have investigated the role of mobile phones in transmission of infection. But most of them were limited to health care settings [4, 5].

Microbiological studies revealed that bacterial growth on mobile phones of health care workers (HCWs) from hospitals was more than 15% which contained various types of bacterial and fungal contamination [6, 7]. Moreover, it has been demonstrated that HCWs' mobile phones provide a reservoir for many harmful pathogens which cause nosocomial infections [8]. Unfortunately, studies have indicated that most staff and patients do not regularly consider preventive measures and never clean their phones. This would increase the probability of cross-contamination of such bacteria on hands and mobile devices of HCWs to many different clinical settings and therefore it would increase the risk of nosocomial infection [9]. The risk of nosocomial infection depends on several factors: firstly, the ability of certain pathogens to remain viable on a surface; secondly, the rate at which contaminated surfaces are being touched, the context in which the patient is exposed, and the levels of contamination that cause the transmission. In this regard, the role of contaminated environmental surfaces in the transmission of healthcare-associated pathogens are critical [10].

According to the authors' knowledge, the number of studies considering the level of contamination among general population is scarce. Thus, the aim of the current study was to assess the frequency of microbiological contamination of mobile phones in general population.

Materials and Methods

Study Design and Participants

This cross-sectional study was conducted in Tehran, capital city of Iran 2015. The study population encompassed participants older than 15 years old from different occupational groups including HCWs, laborers, students, teachers, academic persons, marketers, employees, etc. through a non-randomized sampling method. The protocol of the study was approved by Islamic Azad University, Tehran Medical Sciences Branch review board. After explaining the objectives of the study to the participants, demographic information including age, gender, educational level and occupational status was retrieved by a researcher-made questionnaire.

Sampling and Laboratory Methods

Samples from mobile phones were collected while the researcher was filling the questionnaire, using sterile cotton swabs. Medical and laboratory students were trained by an expert microbiologist to perform sampling process in a standardized manner. Each swab was first moistened with distilled water and was rotated over the surface of both sides of the mobile phones together with the keypad or touchpad. If the participants carry more than one mobile phone, sampling was performed separately by extra swabs from each mobile phone. Between each sampling, disinfectant solution was used to disinfect the hands of the sample collectors to prevent cross contamination. Each sample was labelled with a unique identification code for further evaluation. The samples were kept in transport media and transported to the laboratory for culture within 24 hours of sampling. All swabs were immediately inoculated blood and plates together. Swabs were then sub-cultured on blood agar, Mc Conkey's (Sigma-Aldric, Germany), eosin methylene blue agar (Sigma-Aldric, Germany) and sabouraud dextrose agar plates, which then were incubated at 5–10% CO2 at 35–37° for 48 h. Plates which showed no growth were reported as negative, while those showing any growth were reported as positive. Positive cultures were documented using a semi quantitative method whereby a single individual identified and counted dominant colonial types. Bacteria were identified according to standard protocol. Isolated organisms were processed according to colony morphology and gram stain, pigmentation, catalase, coagulase production and motility.

Statistical Analysis

Data were entered and analyzed using SPSS 18 statistical software. Chi-squared test was used through Fisher's exact test to investigate

differences in categorical variables. P value less than 0.05 was considered significant.

Results

The average age of the participants screened was 23.6±6.6 years; 2208(42.3%) were males and 3009 (57.7%) were females. Demographic characteristics of the study population are described in Table-1.

In 5220 sample retrieved, bacteriological analysis revealed that samples from 5180 (98.9%) mobile phone devices were contaminated with bacteria (2193 sample in male and 2967 sample in female, P=0.07). There was no significant difference between Positive culture and demographic characteristics (Table-1). As indicated in Table-2, the most common isolated micro-organisms included: S*taphylococcus epidermidis* (63.9%), *Escherichia coli* (12.3%) and *Staphylococcus aureus* (11.4%).

Discussion

According to our findings, 98.9% of mobile phone samples from all the study groups were found to be contaminated by bacterial agents. It has been documented that electronic devices such as personal digital tools had the potential for the transmission of nosocomial pathogens by isolating of bacterial agents [11].

Unfortunately, the number of studies conducted for microbiological evaluation of samples from mobile phones among general population is scarce. In a similar study in Nigeria, Akineymi and colleagues indicated that marketers and food vendors had the highest rate of bacterial contamination (37%), followed by lecturers and students (30.6%). This high prevalence was attributed to the poor hygienic and sanitary practices associated with low level of education among these individuals [12].

Table 1. Distribution of Demographic Variables Among Study Population

Variables	Frequency N (%)	Bacterial Culture Growth	
		Positive	Negative
Sex			
Male	2209 (42.3%)	2193	16
Female	3011 (57.7%)	2967	44
Age group			
Below 20	312(6%)	311	1
20-29	1997 (38.3%)	1980	17
30-39	1332 (25.5%)	1331	1
40-49	872(16.7%)	850	22
Above 50	707(13.5%)	688	19
Education Level			
Lower diploma	691 (13.2%)	680	11
High School Diploma	883(16.9%)	880	13
Academic undergraduate	1650 (31.6%)	1635	15
Academic graduate	1996 (38.3%)	1994	21
Occupation Status			
Laborer	1076 (20.6%)	1060	16
Student, teacher or lecturer	2044 (39.2%)	2035	9
Health care worker	663(12.7%)	644	19
Marketers	576(11%)	568	8
Employee	672(12.9%)	664	8

Table 2. Frequency of Micro-Organisms Species Identified from Mobile Phone Samples Among Study Population

Microbial species	Frequency N (%)
Staphylococcus epidermidis	3333(63.9%)
Escherichia coli	642(12.3)
Staphylococcus aureus	595(11.4%)
Bacillus subtilis	138(2.6%)
Proteus vulgaris	121(2.3%)
Actinomyces	58(1.1%)
Klebsiella	48(0.9%)
Streptococcus pyogenes	47(0.9%)
Streptococcus pneumonia	24(0.5%)
Pseudomonas	15(0.3%)
Citrobacter	15(0.3%)
Hemophilus influenza	15(0.3%)
Acintobacter	12(0.2%)
Mixed growth	97(1.9%)
No growth	60(1.1%)

There are various similar studies in hospital settings which investigated the microbial contamination of mobile phones. Selim and Abaza revealed that 100% of their tested mobile phones were contaminated with either single or mixed bacterial agents and the most prevalent bacterial contaminants were methicillin-resistant *S. aureus* and coagulase-negative staphylococci representing 53% and 50%, respectively [13]. Their finding was consistent with previous studies by Utsun *et al*. and Ulger *et al*. who reported 100% and 94% levels of contamination [6, 14]. Besides, there are other studies that reported lower rates of contamination [15-17]. In comparison with previous studies, our study population was the largest sample and this was the main strength of our study. Most of the above-mentioned studies were conducted among HCWs and the high rate of contamination seemed to be disappointing. One reason to explain such a high contamination rate among HCWs is believed to be the unconscious handling of mobile phones while providing health care services. Besides, there is a lack of awareness about nosocomial infections and the lack of awareness about the contamination of their devices by infectious microorganisms among this population [14]. Undoubtedly, microorganisms can be transferred from person to person or from objects to hands. However, currently, the direct association between mobile phone bacterial contamination and individual's status of infection is still unknown. Although, significant overlap between touch-pad smart phones and the skin microbiome of their owners has been identified in recent investigations. Therefore, fomites such as mobile phones can potentially introduce pathogens to areas such as neonatal units [18-20].

In order to reduce the risk of contamination, several pivotal actions including: staff education promotion, strict hand hygiene measures, guidelines on device cleaning and consideration of the restrictions regarding the use of mobile phone technology in certain high risk areas are recommended. Further investigations are required to primarily assess the knowledge, attitude and practice of general population regarding these issues and then evaluate the benefit of such intervention strategies on mobile phone contamination [2].

Conclusion

The frequency of mobile phone contamination is high in general population in Tehran. Although most of the isolated organisms seemed to be non-pathogenic, their colonization may endanger certain populations particularly in health care settings. Educating general population about infection control and underlining individuals' responsibility of infection control are recommended as an important aspect of controlling such infections.

Conflict of Interest

None declared.

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