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ORIGINAL ARTICLE

Contamination of Mobile Phones of Health Care Workers of PIMS Hospital Islamabad

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ABSTRACT

Introduction: Mobile phones are one of the most vital telecommunication devices and are used to stay in touch with both the social and professional aspects of our lives. They have also become an important tool for the rapid delivery of information in healthcare institutions, such as hospitals. However, with many benefits of mobile phone usage, also comes the drawbacks of hospital-associated pathogens surviving on these mobile phone screens.

Objectives: To determine the frequency of contamination of healthcare worker's mobile phones by different types of microorganisms.

Methodology: A cross-sectional study was conducted from June 2020 till December 2020 at PIMS Hospital, a tertiary care hospital located in Islamabad, Pakistan. A total of 121 individual mobile phones were randomly sampled. A simple random sampling method was used. Informed consent was taken before taking a sample and a questionnaire was also utilized.

Results: Among 121 samples collected from different department health workers mobile phone surfaces, 112 showed significant differences (92.56%) which were positively contaminated with microorganisms.

Conclusion: To conclude, a high contamination rate of mobile phones was found with microorganisms. This could lead to serious nosocomial infections. Therefore, a standard guideline on the use of electronic devices and mobile phones should be implemented in hospitals and healthcare centres. Enforce the hygiene practices such as washing hands and cleaning mobile phones a few times a day.

Keywords: Healthcare Worker, Mobile Phone, Microorganism, Contamination, Disinfectant

INTRODUCTION

Mobile phones are one of the most vital telecommunication devices in the 21st century after being introduced to the world in 1982 in Europe. Mobile phones are used to stay in touch with both the social and professional aspects of our lives. They have also become an important tool for the rapid delivery of information in healthcare institutions, such as hospitals thus making healthcare delivery a lot more efficient worldwide (1).

However, along with the many benefits of mobile phone usage, comes the drawbacks of hospital-associated pathogens surviving on these mobile phone screens. This could potentially make mobile phones and other hand-held devices that are frequently used in the hospital reservoirs for transmission of diseases (2).

Bacteria are more likely to grow and form colonies on mobile phones since they are constantly pressed against the palms of our hands. The ideal temperature and moisture provided by the human lead to growth of these pathogens and make mobile phones a prime breeding ground for many microorganisms (3).

A study conducted in 2019 on healthcare workers mobile phones showed that the rate of bacterial contamination of mobile phones was 100%. The most frequently isolated bacteria were *Coagulase Negative Staphylococcus,Bacillus* sp. and *Methicillin-resistant Staphylococcus aureus* (97%, 56%, 17%, respectively) (4).

The bacteria that were most predominantly found was *Coagulase negative Staphylococcus*. *Coagulase negative Staphylococci* are normal resident microflora on the human body; however, its infections are nosocomial (5).

For this reason, it is importantto determine the surface pathogens present on mobile phone surfaces and make sure that healthcare workers are actively disinfecting them.

Increased awareness about the microorganisms found on mobile phones might encourage people to sanitise their phones often, which will help prevent the transmission of diseases and nosocomial infections. (6)

Objective: To determine the frequency of contamination of healthcare worker's mobile phones by different types of microorganisms

METHODOLOGY

A cross sectional study was conducted in June 2020 at PIMS Hospital, a tertiary care hospital located in Islamabad, Pakistan. A total of 121 mobile phones were randomly sampled from individuals working in the hospital. A simple random sampling technique was used. Doctors working in the hospital having touch screen mobile phones were also included. Informed consent was taken with the help of a questionnaire that included questions related to the participants personal information (age, gender, department), usage of mobile phone (storage, the use of a screen protector, using it in the washroom etc.). Furthermore, it had questions about mobile phones' disinfection and their usage during interaction with patients or in the operation theatre. A sterile swab moistened with normal saline was used to make an S-shaped pattern on

the front and back of each smartphone. The swabs were placed in sterile and labelled (serial numbers, source, etc.) containers with a properly filled in proforma of the pathology department of Federal Medical and Dental College. Samples were inoculated on nutrient agar aerobically at 37ºC for 24 hours. The colony grown on the culture plate the Gram staining procedure was done to identify Gram positive rods and cocci and Gram negative rods and cocci. Then other identification tests like coagulase test, catalase test, motility and oxidase test was performed. Definitive biochemical tests were also performed by using API 10S and API 20E (Biomerieux, France) to identify isolate at genus and species level. SPSS version 23 was used to analyse the data.

RESULTS

A total of 121 samples were collected from different department workers' mobile phones. Among 121 samples, 112 samples showed (92.56%) significant contamination with microorganisms (Figure 1).

The demographic details of the total participants that took part in this research are shown in Table 1. Compared to females the male participants were dominant n=67 (55.37%) and females were n=54 (44.63%). Among the participant, n=59 (52.86%) males and n=53 (47.32%) female's phones were found positively contaminated with microorganisms. Besides this, the participant from the surgery department showed the highest mobile phone contamination rate with microorganisms (41.07%). The two pathogens *Staphylococcus epidermidis* and *Staphylococcus aureus* showed a prevalent manner on both sides of mobile phones, as shown in Table 2.

Figure 1 Contamination of mobile phones of health care workers

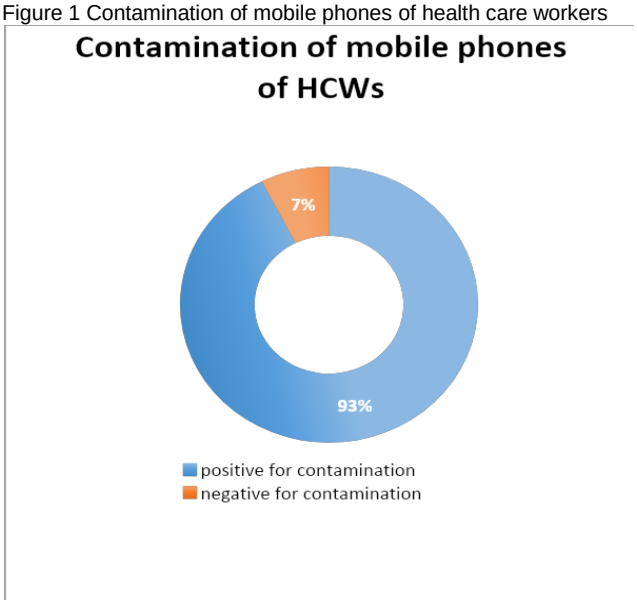

Table 1: Baseline characteristics

		Frequency	Percentage	Positive for microbes	Percentage
Sex	Male	67	55.37 %	59	52.68 %
	Female	54	44.63 %	53	47.32 %
Age group	20-30	32	26.45 %	30	26.79 %
	30-40	29	23.96 %	27	32.14 %
	40-50	37	30.58 %	36	24.11 %
	50-60	23	19.01 %	19	96 %
Designation	Trainee	36	29.75 %	34	30.36 %
	Lecturer	33	27.27 %	32	28.57 %
	Assistant professor	25	20.66 %	24	21.43 %
	Associate Professor	18	18.88 %	16	14.29 %
	Professor	9	7.44 %	6	5.36 %
Departments	Medicine & Allied	47	38.84 %	45	40.18 %
	Surgery	50	41.32 %	46	41.07 %
	Basic	11	9.09 %	9	8.04 %
	Dentistry	13	10.74 %	12	10.71 %
Subspecialty of Medicine & allied	General Medicine	12	9.92 %	12	10.71 %
	Cardiology	8	6.61 %	8	7.14 %
	Pulmonology	9	7.44 %	8	7.14 %
	Gastroenterology	7	5.79 %	6	5.36 %
	Dermatology	5	4.13 %	5	4.46 %
	Nephrology	6	4.96 %	6	5.36 %
Subspecialty of Surgery & allied	General Surgery	12	9.92 %	11	9.82 %
	Orthopaedics	7	5.79 %	7	6.25 %
	Gynaecology	10	8.26 %	10	8.93 %
	Radiology	6	4.96 %	3	2.67 %
	Neurosurgery	7	5.79 %	7	6.25 %
	Cardio-thoracic surgery	8	6.61 %	8	7.14 %
Total		121	100%	112	100%

Table 2: Cross tabulation of microorganisms on both surfaces of mobile phones of health care workers

	Pathogens	Trainee	Lecturer	Assistant Professor	Associate Professor	Professor	Total
Screen	*Staphylococcus epidermidis*	6 (5.36%)	6 (5.36%)	5 (4.46%)	6 (5.36%)	2 (1.79%)	25 (22%)
	Staphylococcus aureus	3 (2.67%)	4 (3.57%)	2 (1.79%)	1 (0.89%)	0%	10 (9%)
	Micrococcus sp.	4 (3.57%)	3 (2.67%)	1 (0.89%)	0%	1 (0.89%)	9 (8%)
	Bacillus subtilis	2 (1.79%)	3 (2.67%)	3 (2.67%)	1 (0.89%)	0%	9 (8%)
	Pseudomonas aeruginosa	2 (1.79%)	3 (2.67%)	1 (0.89%)	1 (0.89%)	1 (0.89%)	8 (7%)
	E. coli	0%	1(0.89%)	1(0.89%)	1 (0.89%)	0%	3 (3%)
	Others	3 (2.67%)	2 (1.79%)	1 (0.89%)	1 (0.89%)	0%	7 (6%)
Total		20 (17.88%)	22 (19.64%)	14 (12.5%)	11 (9.82%)	4 (3.57%)	71 (63%
Backside	*Staphylococcus epidermidis*	4 (3.57%)	3 (2.67%)	3 (2.67%)	2 (1.79%)	0%	12 (11%)
	Staphylococcus aureus	2 (1.79%)	1 (0.89%)	1 (0.89%)	2 (1.79%)	1 (0.89%)	7 (6%)
	Micrococcus sp.	2 (1.79%)	2 (1.79%)	2 (1.79%)	1 (0.89%)	0%	7 (6%)
	Bacillus subtilis	2 (1.79%)	2 (1.79%)	2 (1.79%)	0%	1 (0.89%)	7 (6%)
	Pseudomonas aeruginosa	2 (1.79%)	1 (0.89%)	1 (0.89%)	0%	0%	4 (4%)
	E. coli	1 (0.89%)	0%	0%	0%	0%	1 (1%)
	Others	1 (0.89%)	1 (0.89%)	1 (0.89%)	0%	0%	3 (3%)
Total		14 (12.5%)	10 (8.93%)	10 (8.93%)	5 (4.46%)	2 (1.79%)	
Total (both surfaces)	*Staphylococcus epidermidis*	10 (8.93%)	9 (8.04%)	8 (7.14%)	8 (7.14%)	2 (1.79%)	37 (33%)
	Staphylococcus aureus	5 (4.46%)	5 (4.46%)	3 (2.67%)	3 (2.67%)	1 (0.89%)	17 (15%)
	Micrococcus sp.	6 (5.36%	5 (4.46%)	3 (2.67%)	1 (0.89%)	1 (0.89%)	16 (14%)
	Bacillus subtilis	4 (3.57%)	5 (4.46%)	5 (4.46%)	1 (0.89%)	1 (0.89%)	16 (14%)
	Pseudomonas aeruginosa	4 (3.57%)	4 (3.57%)	2 (1.79%)	1 (0.89%)	1 (0.89%)	12 (11%)
	E. coli	1 (0.89%)	1 (0.89%)	1 (0.89%)	1 (0.89%)	0%	4 (4%)
	Others	4 (3.57%)	3 (2.67%)	2 (1.79%)	1 (0.89%)	0%	10 (9%)
Total		34 (30.36%)	32 (28.57%)	24 (21.43%)	16 (14.29%)	6 (5.36%)	
Gram positive: *Staphylococcus epidermidis, Staphylococcus aureus, Micrococcus sp., Bacillus subtilis*							

DISCUSSION

Mobile phones are used extensively by most individuals in the world today. This includes healthcare workers and it has had a significant impact on the efficiency with which healthcare systems provide services to patients these days. However, nosocomial infections caused by multidrug resistant organisms are growing problems in many hospitals and healthcare institutions (7,8). Previous studies show that since mobile phones are portable, they are often used in close proximity to patients, thus making these patients more endangered to the possibility of nosocomial infection (9,10).

In our study 121 mobile phones were randomly sampled from individuals working in PIMS Hospital. We found that 112 samples (92.56%) were positively contaminated with microorganisms. This concordance with a previous study in which 69% of the samples taken from mobile phones of health care workers were positive for contamination (11). Furthermore, our findings suggest that *Staphylococcus epidermidis* and *Staphylococcus aureus* are the two pathogens that are most prevalent on both the front screen and backside of mobile phones. This result validates the conclusions of another study done in 2016 where they found the prevalence rate of *Staphylococcus epidermidis* to be 84% and *Staphylococcus aureus* to be 54% (12).

Previous studies show that cleaning computers and telephones with 70% isopropyl can reduce bacterial contamination (13,14). It is suggested that simply using other people's mobile phones leads to more chances of being infected with a bacterial pathogen (15). Therefore, various disinfection methods should be studied in the future to help determine which is the most efficacious (16,17). Keeping the recent Covid-19 pandemic in mind it is important now more than ever to help prevent nosocomial infections by issuing standard guidelines about the hygiene practices of electronic devices and mobile phones in hospital (18).

CONCLUSION

To conclude, mobile phones were found to be highly contaminated with microorganisms. This could lead to nosocomial infections and a standard guideline should be issued about the hygiene practices of electronic devices and mobile phones in hospitals and healthcare centres. Cleaning and disinfecting protocols should be followed and maintained to reduce the unnecessary exposure of patients to microorganisms.

Recommendations: Screening of mobile phones for contamination by microorganisms should be done regularly especially within hospital areas (19). Mobile phones should not be used while interacting with patients and in healthcare settings to reduce the risk of transmission of nosocomial infection. Further studies may be conducted based on the results from our data. A study could be conducted on the rate of contamination of patients by nosocomial infections and the microbes found on their respective doctors and nurses' mobile phones. This could directly prove the number of nosocomial infections that are caused by the use of mobile phones by healthcare workers in hospital settings. Another study could be conducted on the number of nosocomial infections in different departments of a hospital comparing that with how lax the rules of usage of mobile phones are around patients in that

specific department. Various disinfection methods of mobile phones and antimicrobial gels could be studied to find the most effective method, including the difference of microorganisms found on the phones that have been disinfected (20). Further research could also be conducted, to determine if there is a significant overlap with the skin microbiome and mobile phones (21) plus the identification and isolation of microorganisms from different parts of the phone (22).

Limitations: Since mobile phones are often used by the entire family including children, this could make them a potentially dangerous vector. However, due to a lack of resources and time we were not able to study the effects of microbial contamination on health care workers' families. We were also not able to find out if multiple colonies and multi-drug resistant bacteria were present on mobile phones of health care workers (23).

Conflict of Interest: There is no conflict of interest declared by any author.

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