

## BACTERIAL CONTAMINATION OF MOBILE PHONES IN A HEALTH CARE WORKERS IN HOSPITALS AND HEALTH CARE CENTERS IN DUHOK CITY, IRAQ

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### Abstract

The indiscriminate use of cell phones by health professionals within the Intensive Care (ICU) Unit is observed. The objectives of this study are to investigate whether there is a bacterial contamination to cell phones of the health professionals and to know whether these professionals perform any type of disinfection on their cell phones. One hundred eighty-six swabs were collected from the surface of cell phones for health worker staff at different hospitals and health care centers in the Duhok city, Iraq. To identify whether professionals performed any type of cleaning agents on their device, a semi-structured questionnaire was applied. It was found that (56.99%) of the mobile phones surface were contaminated with various bacterial profile of them pathogenic. The most prevalent isolated bacteria were: *Staphylococcus epidermidis* (40.16%), followed by *Staphylococcus lentus* (33.07%), *Staphylococcus haemolyticus* (3.15%) and *Pantoea* spp. (3.15%) show some results of whether professionals performed any type of cleaning on their device. It is understood that there is an urgent need for awareness, through continuing education, for the hospital community.

**Keywords:** *Mobile Phone, Bacterial Contamination, Health professionals, Duhok city, Iraq*

### Introduction

Nosocomial infections are an important public health problem at all levels because they prolong hospital stays, increase complications, and raise the cost of patient care. This infection has been strongly associated with the hands of medical personnel and surfaces with which they frequently come into contact (1).

At present, the use of cell phones by health personnel in all entities that concern them has become habitual and necessary, both in professional and social life. The use of these devices within public and private health facilities, especially in the hospital during performing hospital internship observe that the use is very frequent to exchange communication, read, consult on the Internet and even more with the advancement of technology. Constant innovating for the benefit of the society, as long as it is used properly in the right places, its commercialization without any restriction or used to disinfect it. It is possible that it constitutes a source of contamination of pathogenic bacteria for nosocomial infections, that is, a fomite as a transmitter between the owner and places loaded with microorganisms such as bathrooms, kitchens and hospitals (2).

With the advancement of technology, many useful portable electronic items are becoming more frequently used among medical personnel, forming part of diagnostic, monitoring, and treatment tools (3).

The cell phone is not part of medical equipment but it has become so useful that it allows medical personnel of different specialties to keep in touch with their colleagues, share information about patients and even facilitate their locating and allow remote consultations in the event of a medical emergency (2).

Bacterial contamination on hands is of clinical importance while mobile phone manipulation can have adverse health consequences due to the potential for cross-contamination that can be generated with frequent use of mobile phones (1, 4).

The problems that arise when connecting the use of electronic devices in the hospital environment range from the interference they can generate with other devices, by emitting electromagnetic energy, to their potential ability to act as a "fumate" when in contact with other devices. Investigations of bacterial contamination on mobile phones of different hospitals in countries have been carried out at the international level. Finding a large proportion of bacterial contamination and isolation of bacteria of interest in hospitals. However, we do not have studies of this kind in Duhok city.

In the present research, cultures from the surface of cell phones were carried out identifying pathogenic bacteria or those of nosocomial interest. Demonstrating that bacterial contamination in the cell phones of medical personnel is a reality with the possibility of contaminating patients and even the user of the cell phone, being considered a fomites of microorganisms. The current cross-sectional study is the first in Duhok city, Iraq.

The main objective of the current study is to determine personal hygiene and its role in bacterial contamination and transmission of pathogens.

The aims of the present study are diagnosis and isolation of bacteria transmitted to mobile phones by patients, visitors and health workers in different departments of hospitals and health care centers Duhok city, Iraq.

## **Materials and Methods**

### **Design of the Study**

The current research was a Cross-sectional study, in which data were obtained in a questionnaire and laboratory bacteriological findings database.

### **Sample Size**

The present study made up of 186 cell phones of the physicians and healthcare workers at different hospitals and health centers at Duhok city, Iraq.

### **Period of the Study**

The study was started from August 2021 till December 2021.

### **Study Population**

Those who provide services directly or those closest to hospitalized patients and outpatients were listed in the following table (1).

**Table (1): Collection and processing of swab samples from hospitals and health centers staff**

186 swabs from mobile phones	
Consulation Clinic of Duhok Emergency and Accident hospital (12 swabs)	
Duhok Obstetric and Gynecology hospital (12 swabs)	
Duhok Obstetric and Gynecology hospital (12 swabs)	
Teaching Dental Clinic (12 swabs)	
Duhok Eye Hospital (12 swabs)	
Qazi Muhammed Health Center (12 swabs)	
Serhidan Health Center (12 swabs)	
Khabat Health Center (6 swabs)	
Nizarki Health Center (12 swabs)	
Kidney Disease and Transport Center (12 swabs)	
Central Public Health Lab (12 swabs)	
Emergency teaching hospital (18 swabs)	
Heevi Pediatric Hospital (12 swabs)	
Blood Bank (20 swabs)	
Azadi teaching hospital (22 swabs)	
Cultivation on Culture Media	
Blood Agar	MacConkey Agar
VITEK machine	
Results	

### Inclusion criteria

Health workers in hospital, who worked and used their cell phones in hospital areas, emphasizing the professional positions that were held they worked as doctors, nurses, dentists, nursing technicians and interns staff in general.

### Exclusion criteria

Workers who worked in administrative areas or offices of the hospital, as well as those who did not voluntarily agree to sign the informed consent.

### Ethical Consideration

The scientific research committee of the college of medicine/University of Duhok and the Ethics Committee of the Director of Health (No.20092020-4. 20/09/2020) approved the current study. All participants signed both oral and written consent forms.

### Materials

The materials used in the sampling such as sterilized gel transport swab previously purchased from local medical Market. Above swabs were kept at the Microbiology laboratory Amr Private Laboratory, Duhok city.

### Samples

Cell phone surface sample collection was performed after participants were informed of the study objectives and procedures and informed consent was signed,

and workers were asked to have their cell phones used frequently within hospital areas. Sample identification corresponds to the same scan code, encoded in the tube in a way that protects participant confidentiality while the same is being processed.

### **Samples collection**

The sampling was divided according to the shifts of the staff (morning, afternoon and night) and were collected one hour before the end of their shift to increase the probability of contact with patients before the sampling. The samples were collected from the surface of the cell phone; the test tube was labeled with the code corresponding to the participant's information.

### **Sample processing**

Once each sample was taken from the staff members then directly transported in the cool box to the Amr Private Laboratory within a half hour. Sample processing started by labeling the Petri dish with the number corresponding to the participant and cultured on media (Blood Agar, MacConkey Agar, and Mannitol Agar) incubated aerobically at 37° C for 24 - 48 hours. After overnigt a visual inspection was made if there is growth and the number of colonies present on each media. Cultures growth were reported as positive as those with yielding bacterial growth and negative where no bacterial growth was found within 48 hours.

### **Bacterial Identification**

Once the colonies were characterized, a colony of the most abundant groups was taken from each medium for replanting and identification tests were performed by colonies morphology microscopic examination (Gram stain), then by VITEK 2 machine.

### **Identification of bacterial species using VITEK 2 Machine**

Direct Vitek 2 (BioMérieux, France) was implemented to guide bacterial species identification. The Vitek 2 Compact 60 (AES software) Gram-Negative Identification test (GNI) card or Gram-Positive Identification test (GPI) cards were used to identify the bacteria (BioMérieux. Marcy l'Etoile, France).

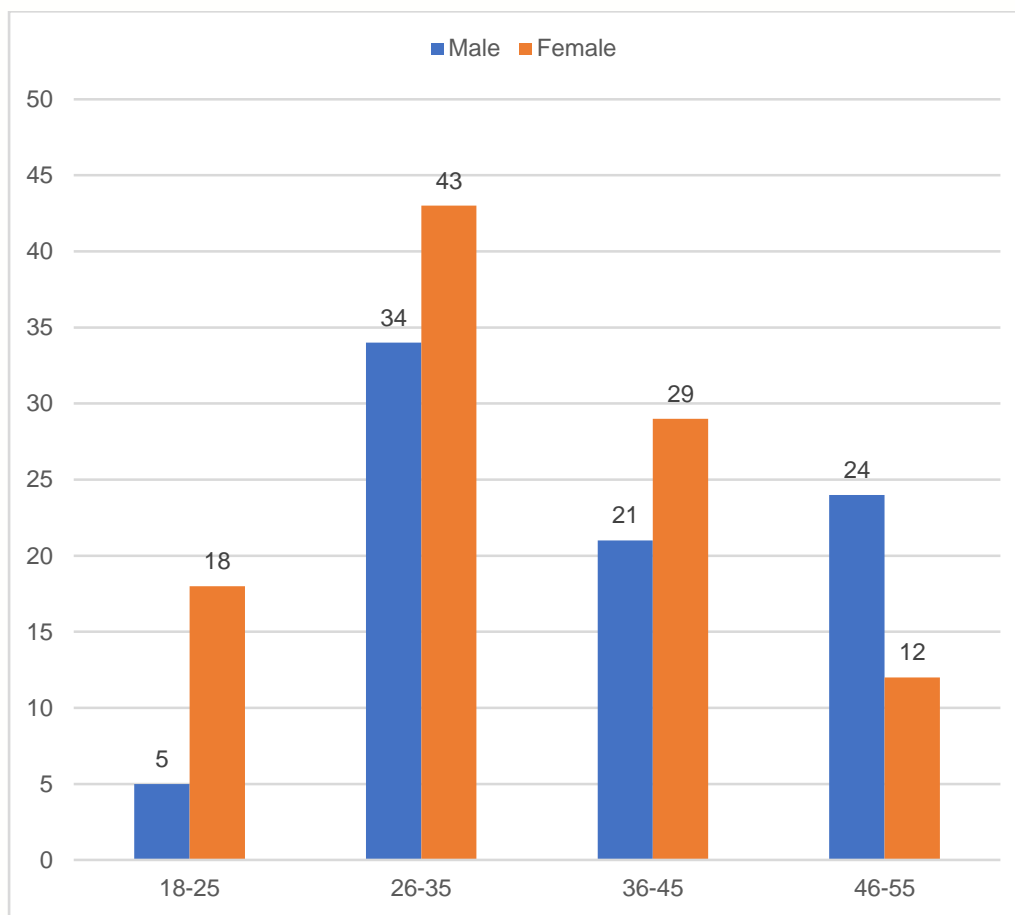
Data obtained from cell phone surface cultures were stored in Microsoft Excel and for processing and interpretation entered into the data matrix described in SPSS v22 statistical software.

## **Results**

### ***Socio-Demographic Characteristics of Participants***

A total of 186 questionnaires were distributed to various hospitals and health centers in the city of Duhok. Among the respondents in the study, the majority 102 (54.84%) were females and 84 (45.16%) males. In terms of age group composition, highest respondents 77 (41.39%) were between the age range of (26-35) years, while lowest 23 (12.36%) were between age range of (18-25) as shown in Figure (1). The mean age of the participants was 32.6 years.

Among the 186 participants, 58 (31.18%) of them wore gloves while working, while 128 (68.82%) did not wear gloves while working as shown in (Table 2).



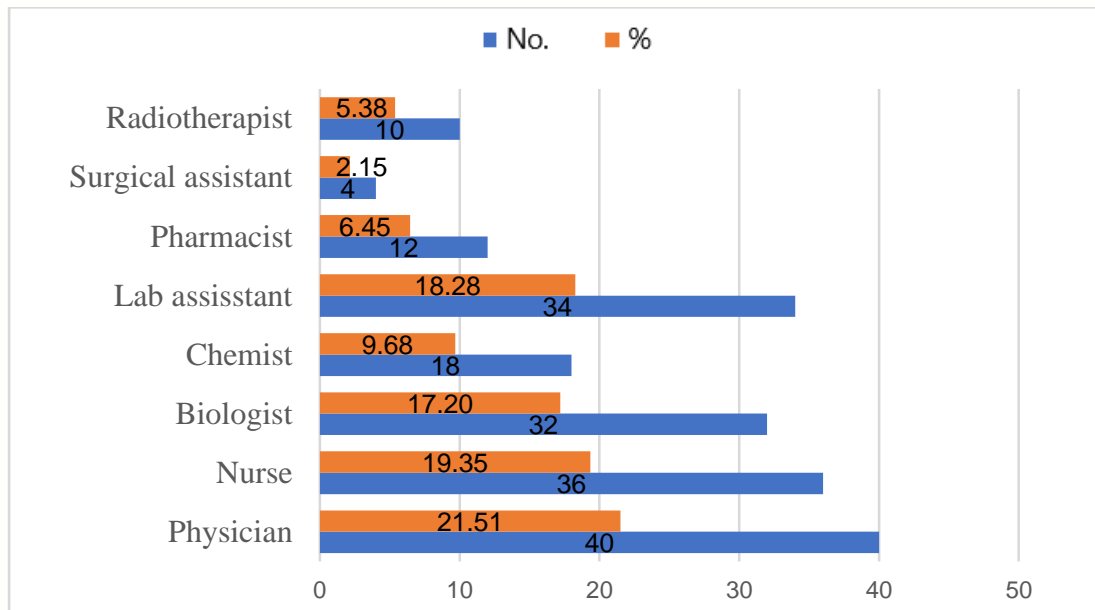
**Figure 1: Age groups and gender of participants**

**Table 2: Socio-demographic characteristics of participants**

Criteria		No.	%
Sex	Male	84	45.16
	Female	102	54.84
Protection	Wearing gloves	58	31.18
	Not wearing gloves	128	68.82
Disinfection	Regular disinfection	22	11.83
	Rarely disinfection	60	32.26
	Non disinfection	104	55.91

***Type of personnel and level of contamination***

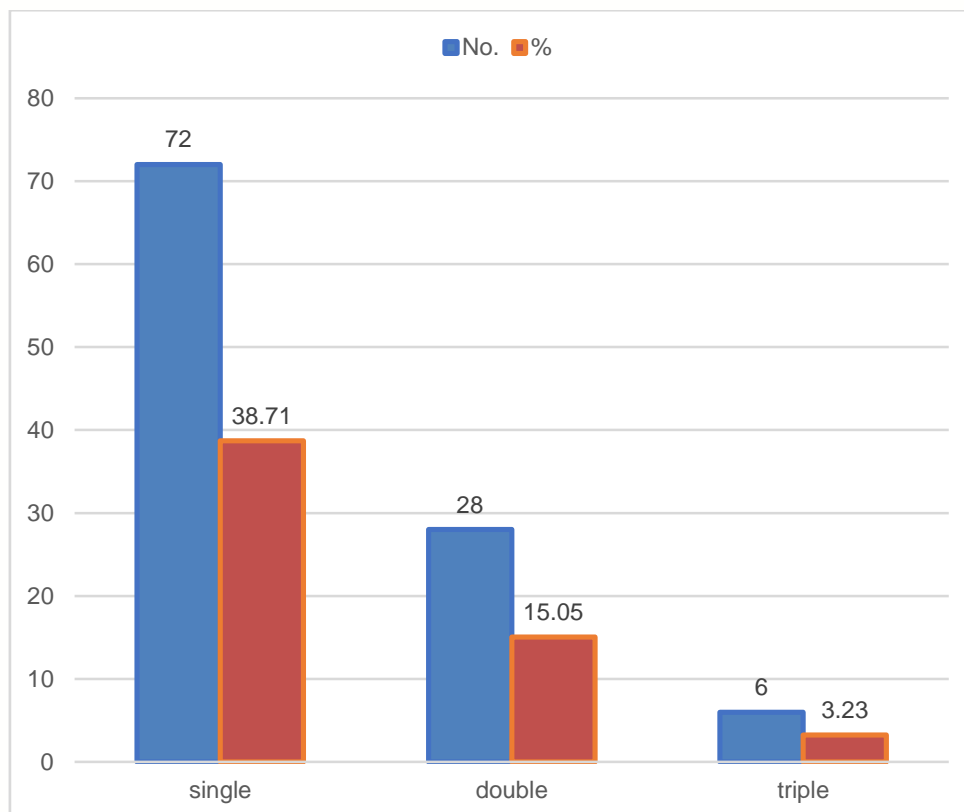
The research was carried out among healthcare workers from Duhok's hospitals and clinics. Physicians 40 (21.51%), Nurses 36 (19.35%), and laboratory assistants 34 (18.28%) were the most common participants in this study, as shown in (Figure 2).



**Figure 2: Distribution of the job of Personals**

***Frequency of bacterial species***

Out of 106 positive cultures, 72 (38.71%) cultures shown single bacterial species, 28 (15.05%) shown mixed double species and 6 (3.23%) show triple species, as shown in (Figure 3).



**Figure 3: Number and percentage of bacteria species per sample**

### Bacterial profile

The bacteria isolated on the surface of the cell phones of health personnel, of greater predominance were: *Staphylococcus epidermidis* 51(40.16%), *Staphylococcus lentus* 42 (33.07%), *Staphylococcus haemolyticus* 4 (3.15%), *Kocuria kristinae* 4 (3.15%) and *Pantoea* spp 4 (3.15%) as shown in (Table 3).

**Table 3: Frequency of pathogenic bacteria**

Isolated bacteria	No.	%
<i>Staphylococcus epidermidis</i>	51	40.16
<i>Staphylococcus lentus</i>	42	33.07
<i>Staphylococcus capitis</i>	2	1.57
<i>Staphylococcus alactolyticus</i>	2	1.57
<i>Staphylococcus hominis</i>	2	1.57
<i>Staphylococcus warneri</i>	2	1.57
<i>Staphylococcus haemolyticus</i>	4	3.15
<i>Staphylococcus aureus</i>	2	1.57
<i>Kocuria kristinae</i>	4	3.15
<i>Corynebacterium diphtheriae</i>	2	1.57
<i>Micrococcus luteus</i>	2	1.57
<i>Pantoea</i> spp	4	3.15
<i>Pseudomonas luteola</i>	2	1.57
<i>Pluralibacter gergoviae</i>	2	1.57
<i>Escherichia coli</i>	2	1.57
<i>Candida albicans</i> (Fungi)	2	1.57
Total	127	100%

### Discussion

The purpose of the current research was to analyze the presence of contamination with bacterial agents in the mobile phones of health workers in hospitals and various health centers in Duhok city/ Iraq. These mobile devices were contaminated on the surface with properly pathogenic bacteria and opportunistic pathogenic bacteria, determining the level of contamination present, the genera and species of bacteria isolated.

The age composition of the respondents showed that an overwhelming majority of the healthcare workers were aged between 26 years and 45 years making up 68.27% of the respondents. This points to a young workforce of healthcare workers in Hospitals and health centers in Duhok city where this study was conducted.

Specifically, 41.39% were between age 26 years and 35 years while 26.88% were between age 36 and 45 years. This means that overall, 68.27% of the healthcare workforce were below age 45 years and this reflects the general age characteristic of the healthcare workforce in present times where young healthcare graduates are being absorbed into the healthcare sectors.

Physicians (21.51%), Nurses (19.35%), and laboratory assistants (18.28%) were the most common participants in this study. The majority of research respondents were physicians and nurses in Duhok healthcare sectors. Furthermore, the female sex dominates of these two professions in Duhok, which may explain the study's high female's participations rate compared to male's participations.

The vast majority of survey respondents (68.82%) stated that they do not use hand sanitizer before and after monitoring patients and do not use gloves during using mobile phone. This result was higher than that found by other researchers in their studies. According to (5), 40% of dental students use contaminated gloves when using their smartphones. In another survey (6) revealed that 36% of medical doctors and 10% of dentists use cellphones while wearing unclean gloves. This is a lower frequency than have seen in the current study.

In the present study, rate of bacterial contamination among health care workers, mobile phones was found to be high in this investigation (56.99%). Other studies conducted in India (South and Southwestern regions) (7, 8), Ethiopia (9), Egypt (10), Turkey (11) and Nepal (12) revealed higher results, with the number of contaminated devices ranging from (70%) to (100%). Other investigations conducted in Ethiopia and the western part of India, however, found similar contamination levels of (30%) and (62%), respectively, (13). Geographical differences, methods used, mobile phone handling, sample sizes and hygiene practices of the studied people may all contribute to disparities in contamination levels.

A considerable proportion of respondents in this study believed their mobile phones were contaminated in work, which could explain why the majority of them reported to wash their hands after handling their phones at work. This suggests that doctors and nurses in hospitals and health centers are aware that their mobile phones could be carriers of microbes that could support to the spread of healthcare-associated infections. Other studies back up this claim, showing that mobile phones can operate as a reservoir for bacteria introduced to cause nosocomial infections, making it easier for them to spread from healthcare staff to patients. (14, 15; 16).

Regarding the possibility for mobile phones to contribute in the spread of about health infections, it is proposed that proper hand hygiene, as well as device cleaning and disinfection, could reduce this risk (17).

Thus, the finding in this study that the majority of respondents reported to wash their hands after handling their mobile phones at work is critical in limiting the spread of about health infections among healthcare workers via mobile phone use. However, another study found that health care workers do not frequently follow hygiene practices such as cleaning their mobile devices and performing hand hygiene before and after using them, despite the fact that they may be aware that these devices may contain dangerous bacteria (15, 18)

A study of (1) observed (93.84%) while (19) of 276 telephones, suggesting that the cell phone is a mobile device that carries germs, because the materials that make it up and how it is used support colonization, growth, and bacterial contamination.

The present study was able to identify the presence of Gram-positive bacteria representing normal flora such as *Staphylococcus epidermidis* (40.16%) was the

most abundant, followed by *Staphylococcus lentus* (33.07%), *Staphylococcus haemolyticus* (3.15%) and *Pantoea* spp. (3.15%) representative of both normal flora and clinical importance as a pathogenic agent; This is explained by the ability of *Staphylococcus* strains to adhere to synthetic materials and by the distribution at the level of the flora of the skin, mouth, nose and hands, which are in contact with cell phones.

Cell phone use within hospital areas should be sterilized or at least included in items that could serve as pets inside. Strengthening practices of sterilization and disinfection of surfaces and activated materials, without neglecting, of course, the basis of prevention of microbial contamination, and hand washing, which should be a standard practice and carried out according to appropriate technology in order to reduce the possibility of contamination and infection of hospital bacteria in hospital areas (5).

### Conclusion

According to the data obtained, on most tested telephones, microbial contamination was detected in medical healthcare. According to results of the current study, the level of microbial contamination of mobile phones is higher than expected among health workers at different hospitals and health centers in Duhok city, Iraq

This study recommend that cell phone using within hospital areas should be sterilized or at least included in items that could serve as pets inside. Strengthening practices of sterilization and disinfection of surfaces and activated materials, without neglecting, of course, the basis of prevention of microbial contamination, and hand washing, which should be a standard practice and carried out according to appropriate technology in order to reduce the possibility of contamination and infection of hospital bacteria in hospital areas.

### References

1. Rodriguez, C.J.A., Zuniga, G.A., Gonzalez, Y.M.G.E., Favela, H.J.M.J. and Garcia, L.C., 2015. Microorganismos de interés clínico aislados de teléfonos móviles. *Química Viva*, 14(1): 103-110.
2. Karabay, O., Kocoglu, E. and Tahtaci, M., 2007. The role of mobile phones in the spread of bacteria associated with nosocomial infections. *The Journal of Infection in Developing Countries*, 1(1):72-73.
3. Delgado, M. and Bravo, J., 2011. Dimensiones de análisis de la telefonía móvil como industria y objeto cultural. *Virtualis*, 2(4): 93-126.
4. Fandoh, M. E., 2018 Mobile Phone Use and Associated Bacterial Contamination In The Neonatal Intensive Care Unit Of The Korle-Bu Teaching Hospital, University Of Ghana, College Of Health Sciences. 54
5. Amoun A, Zinab, A., and Kafa, L. 2020. Investigating the bacterial contamination of mobile phones among dental students in faculty of dentistry Tishreen University. *International Journal of Scientific Research*, 8(12): 29-31.
6. Fard, R.H., Moradi, M. and Hashemipour, M.A., 2018. Evaluation of the cell phone microbial contamination in dental and engineering schools: Effect of antibacterial spray. *Journal of epidemiology and global health*, 8(3-4): 143-148.

7. Chawla, K., Mukhopadhyay, C., Gurung, B., Bhate, P. and Bairy, I., 2009. Bacterial 'cell' Phones: Do cell phones carry potential pathogens? *Online Journal of Health and Allied Sciences*, 8(1): 1-5.
8. Bhumbla, U., Ahmad, S., Mathur, D., Bandey, L. and Mathur, G., 2016. Study on microbial contamination of mobile phones and their role in nosocomial infections in a tertiary hospital of south India. *Asian Journal of Pharmaceutical and Clinical Research*, 9(3): 201-202.
9. Bodena, D., Teklemariam, Z., Balakrishnan, S. and Tesfa, T., 2019. Bacterial contamination of mobile phones of health professionals in Eastern Ethiopia: antimicrobial susceptibility and associated factors. *Tropical medicine and health*, 47(1): 1-10.
10. Shahaby, A.F., Awad, N.S., El-tarras, A.E. and Bahobial, A.S., 2012. Mobile phone as potential reservoirs of bacterial pathogens. *African Journal of Biotechnology*, 11(92):15896-15904.
11. Ulger, F., Esen, S., Dilek, A., Yanik, K., Gunaydin, M. and Leblebicioglu, H., 2009. Are we aware how contaminated our mobile phones with nosocomial pathogens? *Annals of clinical microbiology and antimicrobials*, 8(1):1-4.
12. Karkee, P., Madhup, S.K., Humagain, P., Thaku, N. and Timilsina, B., 2017. Mobile phone: a possible vector of bacterial transmission in hospital setting. *Kathmandu Univ Med J*, 15(59): 217-221.
13. Chaka, T., Misgana, G.M., Feye, B.W. and Kassa, R.T., 2016. Bacterial isolates from cell phones and hands of health care workers: a cross sectional study in pediatric wards at Black Lion Hospital, Addis Ababa, Ethiopia. *J Bacteriol Parasitol*, 7(4): 1-6.
14. Jeske, H.C., Tiefenthaler, W., Hohlrieder, M., Hinterberger, G. and BENZER, A., 2007. Bacterial contamination of anaesthetists' hands by personal mobile phone and fixed phone use in the operating theatre. *Anaesthesia*, 62(9): 904-906.
15. Brady, R.R., Verran, J., Damani, N.N. and Gibb, A.P., 2009. Review of mobile communication devices as potential reservoirs of nosocomial pathogens. *Journal of Hospital Infection*, 71(4): 295-300.
16. Manning, M.L., Davis, J., Sparnon, E. and Ballard, R.M., 2013. iPads, droids, and bugs: Infection prevention for mobile handheld devices at the point of care. *American journal of infection control*, 41(11): 1073-1076.
17. Pillet, S., Berthelot, P., Gagneux-, A., MORY, O., GAY, C., Viallon, A., Lucht, F., Pozzetto, B. and Botelho-Nevers, E., 2016. Contamination of healthcare workers' mobile phones by epidemic viruses. *Clinical Microbiology and Infection*, 22(5): 1-6.
18. Nwankwo, E.O., Ekwunife, N. and Mofolorunsho, K.C., 2014. Nosocomial pathogens associated with the mobile phones of healthcare workers in a hospital in Anyigba, Kogi state, Nigeria. *Journal of epidemiology and global health*, 4(2):135-140.
19. Steinhubl, S.R., Muse, E.D. and Topol, E.J., 2013. Can mobile health technologies transform health care? *Jama*, 310(22):2395-2396.