Microbial contamination of mobile phones: A study of bacterial prevalence

Alaa L.abdullah- Director General of Education Baghdad-Third Rusafa

Hawraa kadhim falhi - Al Kindi Hospital

Dr.Hadi hussein abbas - Al kindi hospital

alaalaebi@gmail.com

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Abstract

Because mobile phone use is so widespread (it was estimated in 2011 that there were around five billion mobile phone users), public concerns about the possible health effects of mobile phones receive a lot of coverage in the media. Because so many people use mobile phones, medical researchers are concerned that any associated health risks, even small ones, could cause significant public health problems. It is important to understand the risks and possible effects of mobile phone use, and make up your own mind about how you use your mobile phone.

A total of (10) (84 %) out of 12 physicians consented to participate in the study , with 2 (16 %) refusing to participate ,bacteria isolated from doctor mobile phone were, staphylococcus spp. was the predominant bacteria, found at 100% prevalence, on both the upper and lower surfaces of the doctor personal mobile phones ,15 % pseudomonas spp. and 5% Klebsiella spp.

Seventeen (90%) out of 19 laboratory workers consented to participate in the research study , while 2 refused (10 %),the prevalence of bacterial isolate from personal mobile phones were , 100% staphylococcus spp was the dominant bacteria on both the upper and lower surfaces of the personal mobile phones of laboratory workers, 67% E.coli , 19.2 % klebsiella spp. and 22 % pseudomonas spp.

A total of 14 (88 %) out of 16 hospital nurses consented to participate in the research study ,with 2 (13 %) refusing to participate, the prevalence of bacterial isolate from personal mobile phones were, 100% staphylococcus spp was the dominant bacteria on both the upper and lower surfaces of the personal mobile

phones of laboratory workers., 34.5 % E.coli , 50 % klebsiella spp. and 11.5 % pseudomonas spp.

A total of 9 (90 %) out of 10 patient accompany consented to participate in the research study ,with 1 (10 %) refusing to participate, the prevalence of bacterial isolate from personal mobile phones were, 100% staphylococcus spp was the dominant bacteria on both the upper and lower surfaces of the personal mobile phones of patient accompany, 9.1 % klebsiella spp.,18.2% pseudomonas spp. and 9.1 % streptococcus spp.

A total of 11 (84 %) out of 14 hospital administration consented to participate in the research study ,with 4 (16 %) refusing to participate, the prevalence of bacterial isolate from personal mobile phones were , 100% staphylococcus spp was the dominant bacteria on both the upper and lower surfaces of the personal mobile phones of hospital administration, 9.1 % klebsiella spp., 18.2 % pseudomonas spp. and 9.1 % streptococcus spp.

Introduction

The global system for mobile telecommunication was established in 1982 in Europe with a view of providing an improved communications network in many countries, mobile phones outnumber landline telephones since most adults and many children now own mobile phones. At present, Asia has the fastest growth rate of mobile phone subscribers in the world. Today, mobile phones have become one of the most indispensable accessories of professional and social life with advancement in telecommunication, mobile phones are used for internet browsing, text messaging, ticket booking, listening music, GPS, and many applications. The vast majority of mobile phones are hand-held Because of the advancement and benefits of the mobile phone, the utility level because high and it is easy to overlook it's hazard to health.

This constant handling of the phone by different users exposes it to an array of microorganisms, and makes it a good carrier for microbes, especially those associated with the skin resulting in the spread of different microorganisms

from user to user Although they are usually stored in bags or pockets, mobile phones are handled frequently and held very close to the mouth, and exposed frequently to the face. However, the mobile phones are used routinely all daylong but not cleaned properly All mobile phones under consideration were infected by several microbes, most of which belongs to natural flora of the human body as well as airborne fungi.

A study reported that many species of commonly found bacteria's such as Staphylococcus aureus, Staphylococcus epidermidis, pseudomonas aeruginosa, Neisseria sicca, Micrococus luteus proteus mirabilis, were identified on mobile phone surface This indicates the necessity to maintain the mobile phones at adequate level of cleanliness. It was reported that a mobile phone can harbor more microorganisms than a man's lavatory seat, the sole of a shoe or the door handle.

Contamination of mobile phones can be through sources such as human skin or handbag, phone pouch, bags, pockets, environment and food particles. These sources are links through which microorganisms colonize the phone, thus causing diseases that range from mild to chronic Although, microorganisms isolated so far by health researchers are mostly normal flora of the source of contamination, they may serve as mobile reseroirs for infections, allowing the transportation of the contaminated bacteria to many different clinical environments further, sharing of mobile phones between people may diretly facilitate the spread of potential pathogenic bacteria to the community.

The potential of mobile phones as vectors to nosocomial infection has been studied before mobile phones were found to carry microorganisms because count of bacteria increases at high temperature and our phones are ideal breeding sites for these microbes as they are kept warm and snug in our pockets and handbags. The important factors of contamination are the personal hygiene

level, location, frequency of usage, duration of usage of the phone and possible number of users. Mobile phones may get contaminated by bacteria (such as Escherichia coli, pseudomonas aeruginosa and klebsiella), which cause hospital infections, and may serve as a vehicle for the spread of nosocomial pathogens Since the same phone is used both inside and outside of the hospital, the phone if contaminated plays a major role in the spread of hospital infection bacteria to the community at large Type of microorganism that occupies the hand phones the most according to studies are the Coagulase negative Staphylococcus, followed by Staphylococcus aureus, thirdly E.coli, followed by other microorganisms like Klebsiella pneumonia,. And p.aeruginosa the frequent use of mobile phone can lead to nosocomial disease which is caused by bacteria like Staphylococcus aureus, pseudomonas, there are various diseases associated with the mobile phone contamination. Some of the diseases are mobile phone dermatitis, in which people who spend longtime on their mobile phone develop an allergic reaction to the phone's nickel surface.

The problem was identified in several published case reports patients with unexplained rashes on their face and ear. Closer investigation revealed that the reaction was caused by nickel in the mobile phone handsets where it is often found in the casing or buttons, particularly in the most fashionable models. Beside this mobile phone affect sperm motility, which an experiment conducted to exposure of human sperm to a mobile phone for 5 minutes significantly decreased sperm motility then in another study the exposure of mobile phone during pregnancy and after birth increased fatal and neonatal heart rate and decreased with increasing gestational age.

Exposure to mobile phone on average 34 minutes per day was associated with decreased nocturnal concentration of hormone melatonin in adults. Mobile phones have become an integral and indispensable part of daily life. Mobile phones are increasingly becoming an important means of communication. The

vast majority of mobile phones are hand-held. Combination of constant handling with the heat generated by the phones creates a prime breeding ground for many microorganisms that are normally found on the skin Mobile phones have also been reported to be a reservoir for microorganisms.

It has been reported that a mobile phone can harbor more microorganisms than a man's lavatory seat, the sole of a shoe or the door handle Although, microorganisms isolated so far by health researchers are mostly normal flora of the source of contamination, they may serve as mobile reservoirs of infection, allowing the transportation of the contaminating bacteria to many different clinical environments. Further, sharing of mobile phones between people may directly facilitate the spread of potentially pathogenic bacteria to the community.

The potential of mobile phones as vectors to nosocomial infection has been studied before. These studies reported that the most commonly found bacterial isolate was Coagulase Negative Staphylococcus (CONs) as a part of normal skin flora. Among Health Care Workers (HCWs), it has been reported that medical devices like thermometers, stethoscopes and non- medical devices like computer keyboards, faucet, ballpoint pens, files, books and mobile phone have an important role in the transmission and spread of microorganisms Bacterial flora on mobile phones of faculty members may vary in composition, number and antibiotic sensitivity, to that found on mobile phones of non-faculty members.

This is probably the first study in Saudi Arabia that attempts to study the bacterial flora present on the mobile phones of faculty members and personnel, and to compare it with that found on mobile phones of personnel in terms of composition, number and antibiotic sensitivity In spite of all the advantages gained from the cell phones, the health hazard it might pose to its users should

not be over looked. Cell phones come in close contact with the body such as face, ears, lips and hands during usage and serve as a ready surface for colonization of pathogenic as well as non-pathogenic microorganisms. So, in addition to the health hazards caused by electromagnetic radiation emission, cell phones could act as a fomite for microorganisms and it can eventually transmit more than just a call Studies in different parts of India show that predominant organisms isolated from contaminated cell phones are Coagulase negative Staphylococci (CoNS) followed by Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae, Acinetobacter sp. Enterococcus faecalis, and Pseudomonas aeruginosa. Multidrug resistant strains were isolated from mobile phones including Methicillin resistant Staphylococcus aureus (MRSA) and extended spectrum beta lactamases producing organisms (ESBL), high-level aminoglycoside-resistant Enterococcus spp, but most of the health professionals are not aware of the fact restriction of usage of mobile phones in hospital settings. Moreover, use of the same phones both inside and outside of hospitals, help to spill out notorious multidrug resistant bacteria of hospital environment in the community.

The wireless technology was invented in the year 1880 by Alexander Graham Bell and Summer Tainted when first time the photo phone was invented in the recent era, there are dissimilar types of mobile phone devices which are utilized for communicating with each other. The mobile telephone sets are also a part and parcel of everyday life all over the globe. The Wi-Fi devices are connected to the exchange of information and data by using the mobile telephones. The Wi-Fi devices also emit the radio waves.

There are so many wireless devices like cell. Phones tablet pcs, audio players digital camera's for children the wireless devices are more serious because they have thinner bony skulls and their neural systems are thin. The network developed during the installation of WLAN by using the router, transmitter,

receiver and the admission levels are solid and all the devices communicate with each other through it. The mobile phone devices also communicate by utilizing the electronic radiations which are more hazardous and cannot protect the human physical structure many studies have reported that the majority of people, including health care workers, do not clean their mobile device. This poses a potential risk factor, as many doctors and nurses not only carry their mobile devices with them, but some have also reported using them while observing patients.

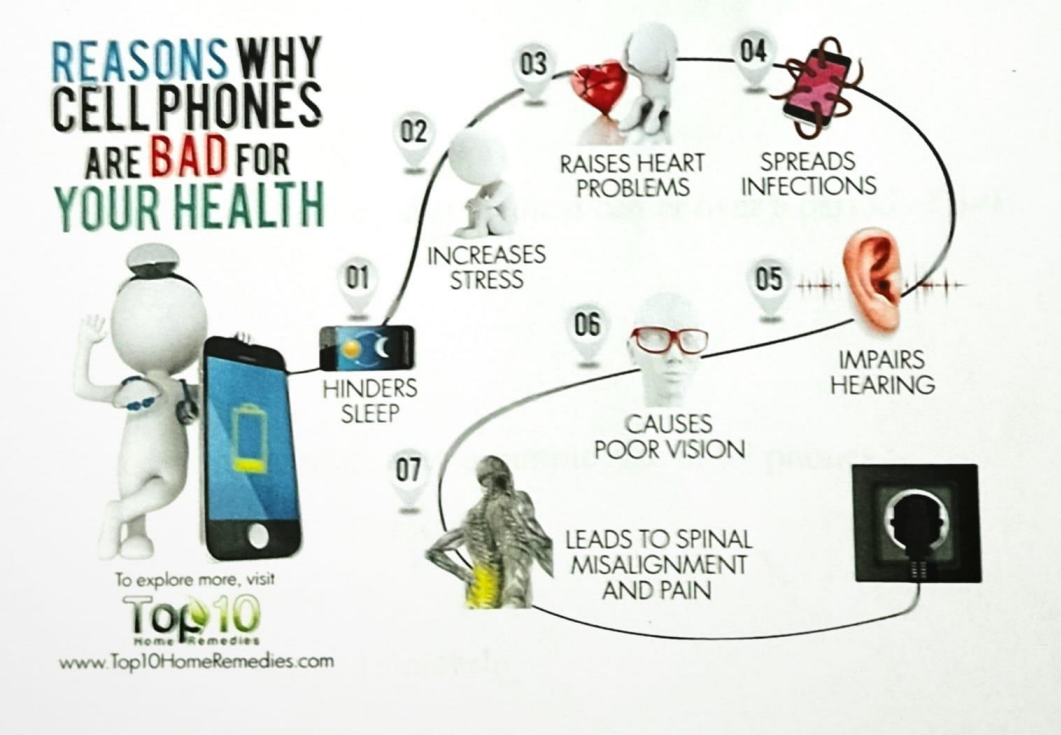
The most widely used disinfecting agent for bacterial contamination of cell phones in these studies is 70% isopropyl alcohol, which works by damaging the bacterial cell membrane and denaturing proteins found in the cytosol. However, recommendations for proper cleaning have not yet been established as many phone manufacturers recommend against using alcohol to clean their phones The correlation between a person's microbiome and one's health is so to speak extremely complex and still rather poorly comprehended] As the research on this matter continuous, the noninvasive sampling of personal items, like cell phones, especially in case of healthcare employees can possibly be useful in the detection and inhibition of the spread of bacteria, hence improving the prevention of probable cross contamination.

Proper care should be taken while using the wireless electronic devices, especially at the point-of care. The same rules should also be applied, at least to some extent, to the patients and visitors of healthcare facilities when they are accessing their mobile phones, since pathogens could potentially spread through their personal belongings including their cell phones, as well. Moreover, the employees of medical facilities and also individuals lacking the medical background including the patients, should be educated about the possibility of the spread of bacteria through their personal belongings, including their wireless electronic devices, since, at least theoretically. Increasing the knowledge about

measures to prevent the probable contamination, may indeed led to lower cross contamination rate

Aims of study

To determine the presence of and characterize the spectrum of bacteria on mobile phones belonging to medical, nursing, allied health staff, students, and caregivers. Also, to advice on best practices based on the results obtained.



Material & Methods

Place of study:

The study was conducted at medical center over a period of 6-9 months 2017.

Sample size:

The study was conduct over a sample size of 94 phones :-

Individual outside = 16 mobile

Doctor 12 mobile

Laboratory worker = 19 mobile

Nurses 14 mobile

Patient company= 15 mobile

Administrators = 18 mobile

Sample collection:

Sterile swabs moistened with sterile demineralized water were rotated over the surfaces of the mobile phone by rotated the surfaces of the mobile phone by rotating the swabs on the key, mouthpiece, and ear-piece. Sample swabs were steaked over as the following:

1- Blood agar

2- Nutrient agar

3- MacConkey agar

4- EMB

5- Mueller Hinton agar

Nutrient agar

Direction:-

Suspend 28,00 gms in 1000 ml distilled water, heat to boiling to dissolve the medium completely, dispense as desired & sterilize by autoclaving at 15 ibs pressure (121 c) for 15 minutes mixwell before pouring

- Company Hi-media

Blood agar

Direction:-

Suspend 40,0 grams in 1000 ml distilled water heat to boiling to dissolve the medium completely sterilize by autoclaving at 15 (ibs) pressure (121 c) for 15 minutes cool to 45-50 c & defibrinated blood, mix well and pouring sterile petri plate.

- Company Hi-media

EMB

Direction:-

1- Suspend 36,0 gm of the powder in 1000 ml distilled water

2- Mix thoroughly until the suspensions is uniform

3- Heat with frequent agitation to dissolve the powder completely AVOIDOVERHEATING

4- Sterilize by autoclaving at 121 c (15 ibs pressure) for 20 minutes

5- Cool to 50 c and shake the medium to oxidase them ethylene blue and to suspend the flocculent precipitate

6- Pour into sterile petri plates

- Company Hi-media

MacConkey Agar

Direction:-

1-Suspend 51.53 g of the powder in 1000 distilled water and mix thoroughly

2- Boil with frequent agitation to dissolve the powder completely AVOIDOVERHEATING

3- Sterilize by autoclaving at 121 c (15 ibs pressure) for 15 minutes

- Company Hi-media

Mueller Hinton agar

Direction:-

Suspend 38.0 grams in 1000 ml distilled water heat to boiling to dissolve the medium completely sterilize by autoclaving at 15 ibs pressure (121 c) for 15 minutes cool to 45-50 c mix well

- Company Hi-media

Plates were incubated aerobically at 37c for 24 48 h gram positive and gram negative bacteria were identified as per standard microbiological procedures depending on gram stain. colony morphology, haemolytic reaction and biochemical reaction (catalase, coagulase(slide and tube) DNAse production) Gram negative bacilli were identified by gram staining, colony, morphology, lactose fermentation, and motility and further biochemical test like indole production, sugar fermentation and H2S production, urease production, citrate utilization, and oxidase test.

The bacteria that isolated from mobile phone are tested for resistance and not resistance for the antibiotic of the following:

1- Amoxil (AMC 30)

2- Doxy-cyclin (DXTT 30)

3- Methicillin (ME 5)

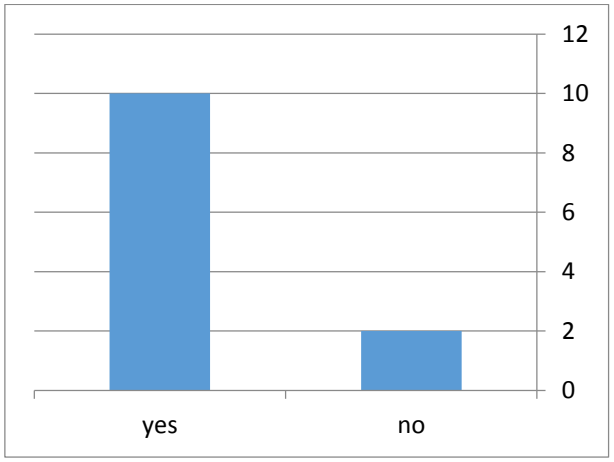
4- Cipro Floxacin (cip 5)

5- Vancomycin (Va 30)

6- Cefrraxycin (CRO 10)

The Result:

Table (1): Doctor Response			
yes	percent	No	percent
10	84%	2	16%



Doctor Response						
	Cases					
	Included		Excluded		Total	
	N	percent	N	percent	N	percent
Staph.	20	100%	0	0%	20	100%
Pseudo.	3	15%	17	85%	20	100%
Klebsie.	1	5%	19	95%	20	100%

One-Sample Test						
Test Value = 0						
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Staph.	7.937	19	0.000	10.500	7.73	13.27
Pseudo.	3.464	2	0.074	2.000	-0.48	4.48

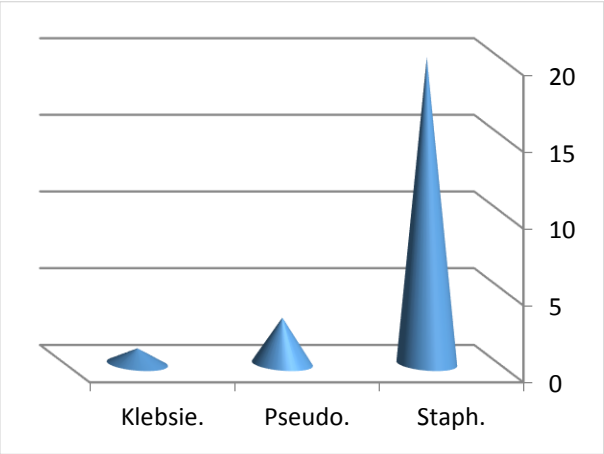
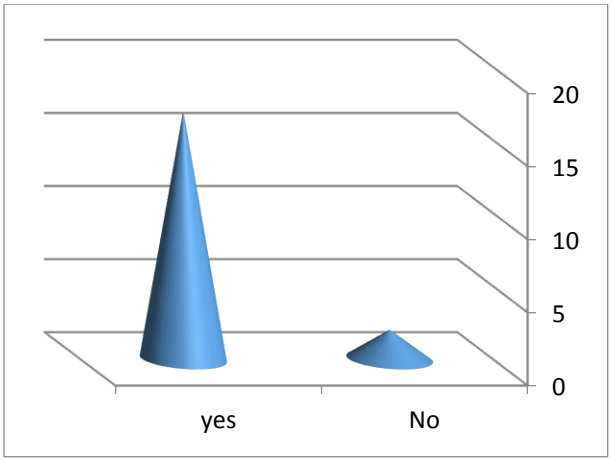


Table (2): Laboratory Worker			
yes	percent	No	percent
17	90%	2	10%



Laboratory Worker						
	Cases					
	Included		Excluded		Total	
	N	percent	N	percent	N	percent
Staph.	18	100.0%	0	0.0%	18	100%
E.coli	12	67%	6	33%	18	100%
Klebsie.	9	50.0%	9	50.0%	18	100%
Pseudo.	4	22%	14	78%	18	100%

One-Sample Test						
Test Value = 0						
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Staph.	7.550	17	0.000	9.500	6.85	12.15
E.coli	6.245	11	0.000	6.500	4.21	8.79
Klebsie.	4.998	7	0.002	5.125	2.70	7.55

Pseudo.	3.873	3	0.030	2.500	0.45	4.55

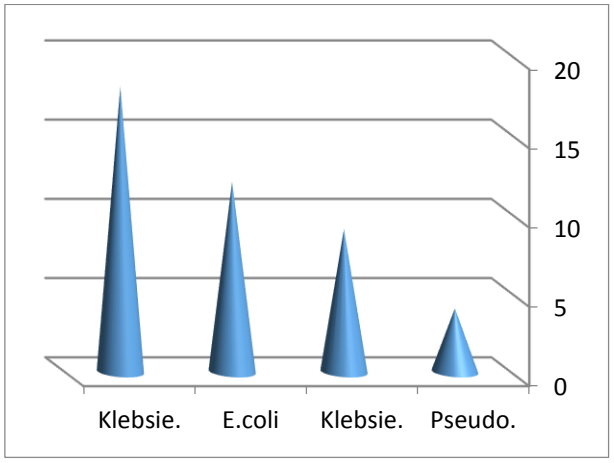
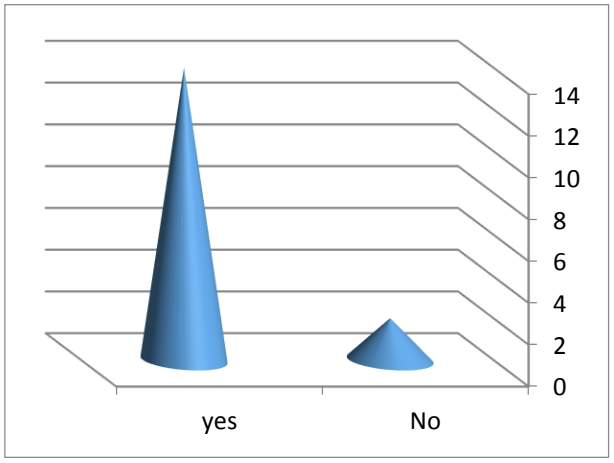


Table (3): Nurses Responses

yes	percent	No	percent
14	88%	2	13%



Nurses Responses			
	Cases		
	Included	Excluded	Total

	N	percent	N	percent	N	percent
Staph.	26	100.0%	0	0.0%	26	100%
E.coli	9	34.5%	17	65.4%	26	100%
Klebsie.	5	19.2%	21	80.8%	26	100%
Pseudo.	3	11.5%	23	88.5%	26	100%

One-Sample Test						
Test Value = 0						
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Staph.	9.000	25	0.000	13.500	10.41	16.59
E.coli	5.477	8	0.001	5.000	2.89	7.11
Klebsie.	3.220	3	0.049	2.750	0.03	5.47
Pseudo.	3.464	2	0.074	2.000	-0.48	4.48

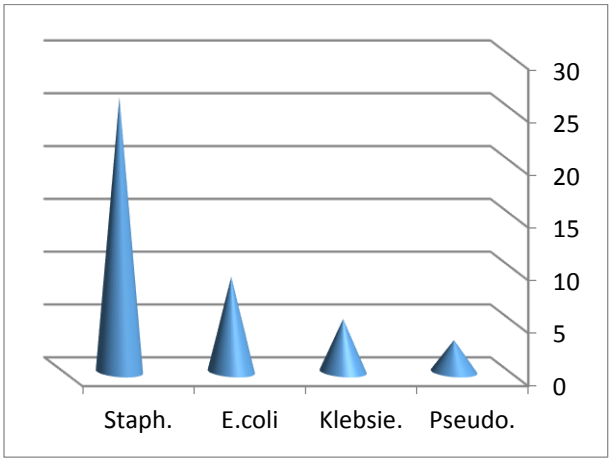
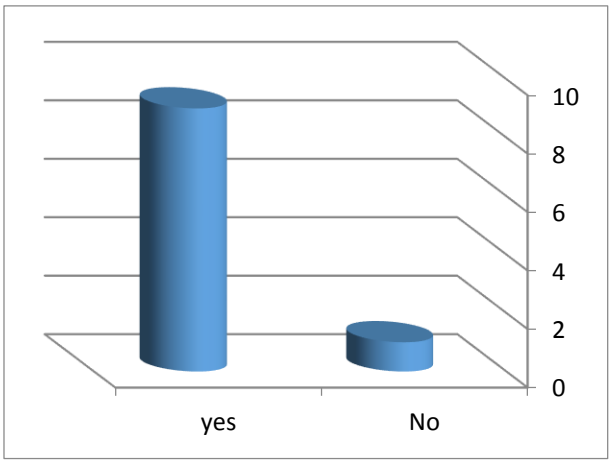


Table (4): Patient accompanying

yes	percent	No	percent
9	90%	1	10%



Patient accompanying						
	Cases					
	Included		Excluded		Total	
	N	percent	N	percent	N	percent
Staph.	11	100.0%	0	0.0%	11	100%
Klebsie.	1	9.1%	10	90.9%	11	100%
Pseudo.	2	18.2%	9	81.8%	11	100%
Strepto.	1	9.1%	10	90.9%	11	100%

One-Sample Test					
Test Value = 0					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference

					Lower	Upper
Staph.	6.000	10	0.000	6.000	3.77	8.23

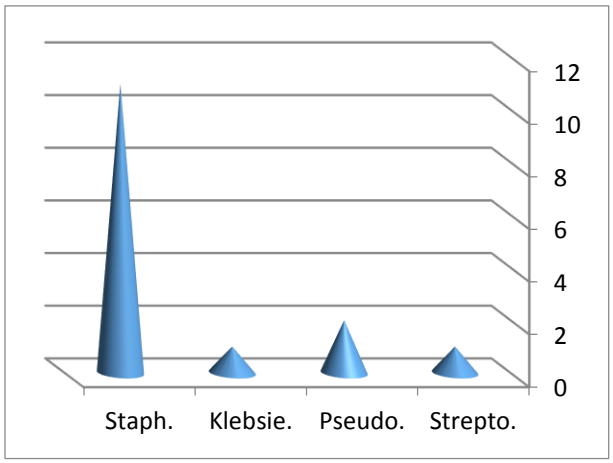
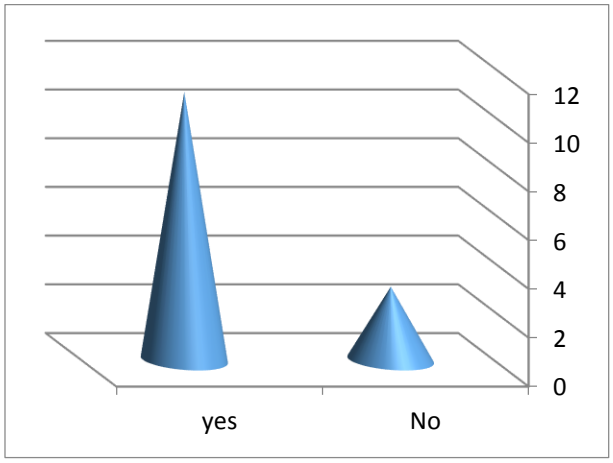


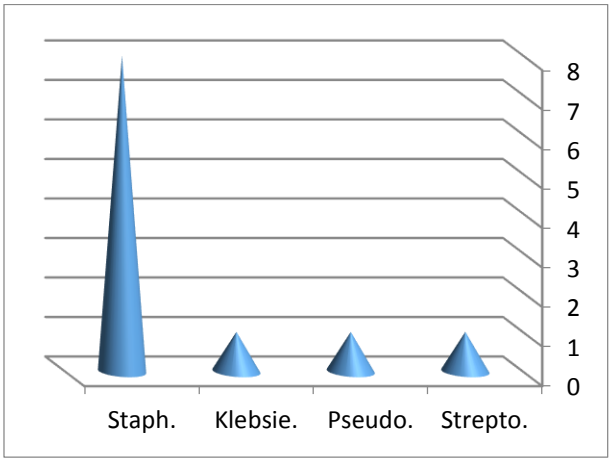
Table (5): Administrators in hospitals			
yes	percent	No	percent
11	84%	3	16%



Patient accompanying

	Cases					
	Included		Excluded		Total	
	N	percent	N	percent	N	percent
Staph.	8	100.0%	0	0.0%	11	100%
Klebsie.	1	9.1%	10	90.9%	11	100%
Pseudo.	1	18.2%	9	81.8%	11	100%
Strepto.	1	9.1%	10	90.9%	11	100%

One-Sample Test						
Test Value = 0						
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Staph.	4.000	10	0.000	2.000	3.77	8.23



Discussion:

Studies conducted around the world show the prevalence of microbial contamination in cell phones of medical staff. Study in Turkey showed that 91% of cell phones of medical staff were contaminated with bacterial agents, study in India, 99% of cell phones were contaminated with bacteria, study in Nigeria, 30.6% of cell phones of medical staff were contaminated with bacterial agent, study in Egypt, 96.5% of samples showed positive cultures.

Another study in Turkey, showed that 94.5% of cell phones of the operation room and ICU personnel were contaminated with various bacteria. Study in Ghana, 47% of cell phones of medical students were contaminated with bacteria, study in Kerman, 32% percent of cell phones of medical staff were contaminated with bacterial agents. Results of in India indicate 70% of contamination of the cell phones of health workers. Singapore showed that 71% of cell phones of health workers resulted in positive microbial growth. As discussed above, some studies reported higher prevalence of microbial contamination and some showed lower prevalence compared to the reported prevalence in this study. This may be due to different attitudes towards infection spread via cell phones and the diversity of cleaning and disinfecting plans in different countries and different health care centers. Collectively, 8 types of bacteria were isolated from 30 cell phones, the most prevalent of which was Staphylococcus epidermidis which was observed in 26.7% of samples (8 cell phones).

Staphylococcus epidermidis the most important member of coagulase negative staphylococcus and part of human normal microbial flora located in nasal mucus and higher respiratory tract. This bacteria was long considered saprophyte due to its ubiquitous nature and relatively low pathogenicity. However, in recent decades, as an implantable medical device, such as catheters and prostheses, it emerged as an important nosocomial pathogen. While no

colonies of Staphylococcus epidermidis have been observed on cell phones, cell phones can transfer these pathogens by contacting with other plastic surfaces such as catheters or prostheses, and by this way they let them in the body. Generally, Staphylococcus sp. are becoming prevalent and statistical analysis in most countries has shown that staphylococcus epidermidis is the most prevalent cause of sepsis and of common causes of urinary tract infections Cellular phones due to the their high temperature and moisture content of the operatory becomes suitable surface for microbial growth. In the present study cultures from the samples showed potential pathogens such as Micrococcus, E. coli, Klebsiella, Streptococcus, Staphylococcus Aureus, Moraxella, and Acinetobacter.

Most of these organisms get killed within hours due to drying, but bacteria like Staphylococcus aureus and Acinetobacter are resistant to drying. can survive for weeks, and multiply rapidly in a warm environment In addition to all these, following hand hygiene protocol is equally important to avoid cross contamination. Gloves should be worn prior to contact with patients and should always be changed between the patients. Since glove use does not preclude the need for hand hygiene after removing them there is definite need to perform hand hygiene procedure prior to and following direct contact with patients.

Research has found that prolonged use of gloves and the use of products like disinfectants, composite resins, and alcohol may increase the permeability of these gloves there are various similar studies in hospital settings which investigated the microbial contamination of mobile phones. Slim 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. Their finding was consistent with previous studies by (UTSUN et al. and ULGER et al). Who reported 100% and

94% levels of contamination besides, there are other studies that reported lower rates of contamination 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 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 at the same time, mixed infection was found more among laboratory technicians followed by workers than among doctors and nurses.

Technicians in the hospital laboratory are often exposed to a wide range of pathogenic and multi-resistant micro-organisms during handling different types of samples in their work. In the study conducted by TAMBE & PAI) the isolation of bacterial flora was seen to a greater extent among the laboratory technicians and the ward boys as compared to the nurses and the doctors similar findings were reported by Trivedi et al as the highest bacterial contamination of mobile phones (52%) were found among HCWs other than nurses and doctors, followed by nurses (50%) and finally doctors(38%) although most cell phones tested were contaminated with one or more microorganisms, contamination with s.aureus was found in 17 cell phones this represents ahigh percentage of

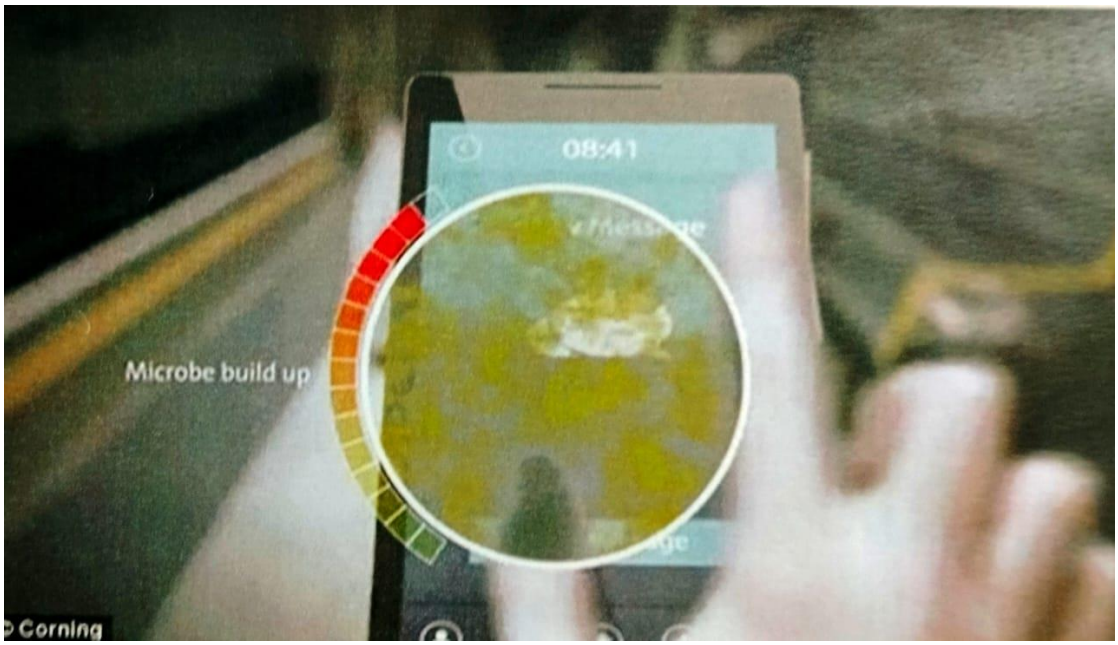
contamination with this pathogenic organism that is commonly found in toilets nevertheless, according to our statistical analysis, there was no correlation between the use of cell phones in toilets and the presence of saureus (p=0,085) Evidence from previous studies revealed that almost 20% of cell phones belonging to doctors and nurses are contaminated with pathogenic bacteria given that medical students are presentin healthcare settings,mobile devices belonging to this group may act as vehicles for transmission of infection to patients if these devices are not used cautiously.

Medical staff particularly are likely to use their phones whilst on a ward round. The phone is used for both personal and work related reasons. The doctor often uses his/her phone to check doses of medication, to calculate doses of medication, to look up causes of a particular symptom or sign, to read up on side effects of drugs/etc. Not all doctors clean their hands before or after using their phones, particularly if their phone rings whilst they are examining a patient. This exposes both themselves as well as their patients to risk of transferring infections. The doctor can transfer microorganisms from the patient to their own hands, and from their hands to their phones, and from their phones to their faces, mouths and ears. In reverse, the doctor can transfer microorganisms from the phone to the patient that they are examining. Nursing staff phones had the lowest rate of contamination. This is most likely due to the restrictions placed on the use and carrying of mobile phones by nursing staff.

In King Edward hospital, nurses are not permitted to use their mobile phones during the times that they are on duty in the ward Gold blatt 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 grimy 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.



Conclusion:

According to the answered questionnaire by the participants, all the studied society were aware that cell phones might be microbial vectors especially for nosocomial bacteria and indicated that cleaning cell phones could be helpful in reducing this risk. Nevertheless, 13.3% of participants did not clean their phone any time a day at all. This rate is lower compared to previously reported rates. In Ali Gardasil et al.'s study, it was proved that almost 94% of medical staff (doctors, medical students, nurses, and paramedics) were aware that cell phones might be microbial vectors especially for nosocomial bacteria. However 44% percent of them never cleaned their cell phones.

In Morioka study, despite the awareness of nurses to wash their hands after routine procedures, 33.6% of them did not wash their hands after using cell phones. In ZAKAI et al.'s study. 67.6% of medical students indicated that they did not clean their cell phones even once a day. Some other studies have shown that nearly 80 to 92% of health care personnel do not clean their cell phones at all Moreover, results of the current study showed that cleaning cell phones results in a significant decrease in microbial contamination on the surfaces of cell phones, as such microbial contamination was significantly less frequent after cleaning the cell phones ($P < 0.001$). These findings were consistent with previous studies, it has been shown that a suitable method to disinfect cell phones is cleaning them with alcohol 70% which results in less contamination.

Recommendations:

1. Emphasis should be given on strict guidelines regarding cellphone use and disinfection in dental care setting. Cellular phones should be regularly wiped with 70 percent isopropyl alcohol.

2. Hand washing should be practiced both before as well as after finishing the clinical procedure.

3. Gloves should be worn and changed for each patient.

4. Cellphone use in between the clinical procedure should be avoided. If at all has to be used, then thorough hand washing before and after use of cellphone is necessary.

5. Manufacturers should provide clear disinfection guidelines and emphasis more on development of equipment's such as antibacterial covers, UV chambers, decolonizing cellphone charger for the decontamination of cellular phones.

6. CDE programmers should be organized to create awareness among dental personnel regarding the role of mobile phones as fomites in transmission of nosocomial infections

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