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Research article

ALERT!!! BEWARE OF MOBILE PHONES!!! HAS A GREAT ROLE IN DISEASE TRANSMISSION, CLEAN THEM UP!!!! SAFE TO HANDLE...

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ABSTRACT

Introduction: Socially and professionally mobile phones are indispensable and are used in an environment of high microbial flora. This study is alerting to "Beware of Mobile Phones!!! has a great role in disease transmission". **Aims and Objectives:** This study deals with the spread of both hospital and community associated microbial infections from the unavoidable mobile phones.**Materials and Methods:** Sterile samples were obtained from 255 mobile phones and divided into 5 categories of people as follows: Group I – Market vendors, Group II – Public workers, Group III – Teachers, Group IV – Office Staffs, Group V– Healthcare workers. Samples were cultured aerobically, anaerobically and for fungus. The resulting isolates were biochemically identified and subjected to antimicrobial sensitivity tests by Standard procedures. **Results and Discussions:** The result revealed a very high percentage (83%) of microbial contamination with 15 bacterial and 5 fungal isolates. Mobile phones in Group I had the highest rate of colonization (54, 25.5%), Followed by Group II (52, 24.6%), Group III (48, 22.7%), Group IV (42, 19.9%), and Group V (15, 7.1%). *Acinetobacter baumanii* was the most prevalent bacterial agent from mobile phones in Group V (33.3%) and least from Group IV (9.5%).There was no statistical significance difference (P<0.05) in the occurrence of *Acinetobacter baumanii* a soil opportunistic pathogenic bacterial agent most frequently isolated from the mobile phones of all the study groups. **Conclusion:** The colonization rate of mobile phones may serve as a reservoir, immediate source and spread of both hospital and community associated microbial infections. Hence mobile phone users are strict adherence of infection control, such as hand washing and good hygienic practices is advocated. To prevent the health care associated infections (HCAI) in hospitals, the use of mobile phones during working hours should be strictly prohibited.

Keywords: Mobile phones, Health care associated infections (HCAI), Health Care Workers (HCWs)

INTRODUCTION

Healthcare associated infections increase day by day and such infection causes significant rate of mortality and morbidity. The etiological agents of hospital infections may spread

through the hands of healthcare workers (HCWs), thermometers, stethoscopes, computers, and mobile phones[1]. Mobile phones continue to have an increasing presence in almost every aspect of our occupational, recreational, and residential environments. In the higher school, university environment, teachers, and students have indicated that 100% have access to computers and mobile phones, 92.1% regularly use the internet, and 73.3% regularly use e mail[2].

The mobile phones are the indispensable accessories of professional and social life used in hospitals, laboratories, and intensive care units when dealing with severe illness. In the present study alerting to "Beware of mobile phones" has a great role in disease transmission, 20 isolates of microorganisms [15 bacterial and 5 fungal] was conducted to determine that the mobile phones of various groups and healthcare workers (HCWs) are act as the vehicles of health care associated infections.[3] A strict hygienic practices as an effective preventive measure [4,5] The first study of bacterial contamination of mobile phones was conducted in a teaching hospital in Turkey [6]. In a study conducted in New York were found to isolate pathogenic microorganism [7]. In this study the frequent use of mobile phones is common so microorganisms are likely high, such as in market vendors (fish, poultry, animal slaughter areas), school teachers, public workers, office staffs and there was a gross reduction in HCWs due to the use of alcohol based hand rub and the prohibition of mobile phones during working hours. Therefore, the present study was conducted to determine whether mobiles phones could play a role in the transmission of microbial pathogens and to strictly adhere to the control of infections reservoir or mode of transmission of infection.

MATERIALS AND METHODS

A total of 255 mobile phones were randomly sampled. The surface samples were obtained from the following study groups for two months between October and November 2011, the work was done in the Microbiology lab in Al Mana General Hospital, Saudi Arabia. Group.1:55 market vendors, Group.2: 58 public workers, Group.3:52 teachers, Group.4: 55 office staff and Group.5: 35 Healthcare workers. The users of these mobile phones were adult volunteers. The concept of the study was explained to all respondents and their consent sought. Respondents were also asked to answer question regarding disinfection practice like - How frequently they cleansed their phones, Cleansing agent used, Washing hands before and after using the mobile phones, etc.

Sample collection and Bacteriological Analysis: The local research ethics committee reviewed the protocol and confirmed. Consent was obtained from the respondents after the goal of the study was explained to them, and they were told that participation was voluntary and responses would be confidential. The samples collected aseptically by using swabs moistened with sterile normal saline, was rolled over all exposed outer surfaces of the mobile phones. From each location those collected samples were inoculated into Amies transport medium. Sampled swabs were streaked over blood agar, Mac-conkey agar and Thioglycolate medium (Oxoid) for the characterization of aerobic bacteria, the plates were incubated aerobically at 37°C for 24-48 hours. For the anaerobic bacteria Neomycin blood agar with Metronidazole5 µg disc at the center of the streaked area were incubated anaerobically at 37°C for 48 hours. A Saboraud Dextrose Agar plate for fungus isolation.

Culture reading and interpretation was done by presumptive identification methods[10]. Other tests like production of coagulase enzyme by Staph aurex kit (Latex agglutination test-Oxoid, U.K) and utilization of oxidation/fermentation (OF) glucose and mannitol. Gram positive catalase negative cocci were tested using a Streptex kit (Latex

agglutination test- Oxoid, U.K). Identification of gram negative bacilli were tested using API 20E system and API 20 NE system for Enterobacteriaceae and non-enteric Gram negative rods (Biomerieux, Marcy l' Etoil, France). Neomycin Blood agar with Metronidazole (5µg) sensitive isolate further identified by (Mast Diagnostic Method) Anaerobic Identification kit and API 20A test (Biomerieux, Marcy l' Etoil, France). All *Staphylococcus aureus* and *Enterococcus faecalis* strains were screened for oxacillin and vancomycin resistance.

Susceptibility Testing: The identified organisms are tested for susceptibility according to Clinical Laboratory Standards Institute (CLSI) antibiotic disc susceptibility testing guidelines.[11]

The following antibiotic agent were tested for the isolates:- Amoxicillin (10µg), Augmentin(30µg),Cefepime(30µg),Ceftazidime (30µg),Cefuroxime(30µg),Cephalexin(30µg),Ciprofloxacillin(5µg), Clindamycin (2µg), Colistin (30µg), Erythromycin(15µg), Gentamycin(10µg), Imipenim(10µg), Metronidazol(5µg), Oxacillin(1µg), Pencillin (10Units), Piperacillin(100µg), Tazocin(110µg), Trimethoprim(1.25µg) and Vancomycin (30µg). The diameters of the zones of inhibition were measured with a ruler and compared with a zone-interpretation chart[11]. *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853 *Staphylococcus aureus* ATCC 25923 and *Streptococcus faecalis* ATCC 29212 strains were used as the control.

RESULTS

Out of the 255 samples 211 mobile phones with bacterial growth and 44 samples showed no growth. The result of this study revealed a high percentage (83%) were contaminated with 15 Polymicrobials and 5 fungal isolates. From the five groups (I-V) studied, 1st Group [market vendors] had the highest rate of contamination

(54, 25.5%). IInd Group [public workers] had the next highest (52, 24.6%); IIIrd Group [teachers] (48, 22.7%) the next highest and the IVth Group [office workers] (42, 19.9%) the last highest. Vth Group [Health care workers] had the lowest rate of contamination (15, 7.1%) (*Figure1*).
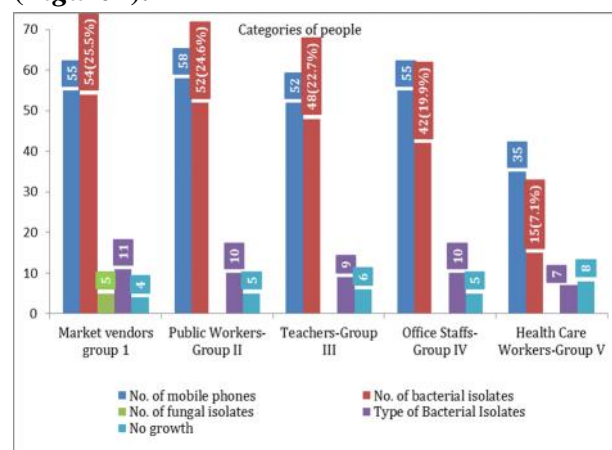

**Fig.1: Mobile Phone Contamination in Hospital and Community Settings**

Specifically, *Acinetobacter baumanii* (47) was the most frequently isolated aerobic bacterial agent from the mobile phones of 33.3%, 27.7%, 23.0%, 22.9% and 9.5%, of Groups V, I, II, III and IV in an order. These results were followed closely by *Coagulase Negative Staphylococci* (31),*Non–fermenting Gramnegativebacilli (29), Chryseomonas luteola(15), Klebsiella pneumonia(13),Enterococcus faecalis (13),Enterobacter cloacae(10),Pseudomonas aeruginosa (10), Micricoccus(9), Bacillusspp(9), Diptheroids(9),Staphylococcus-aureus(7), Escherchia coli(4), Clostridium spp(3) and Anaerobic Bacteroides fragilis (2) (Figure 2)*.

There was no statistical significance difference (P<0.05) in the occurance of *Acinetobacter baumanii*, a soil opportunistic pathogenic bacteria isolated from the mobile phones of all the study groups. Many of the community associated organisms were isolated from the hand to mobile phones of the public workers and market vendors. The wide spread fungal isolates(5) were found in the mobile phones of the Group I market vendors are *Candida*

albicans, Aspergillus spp, Fusarium spp, Mucor and Rhizopus (Figure- 3).
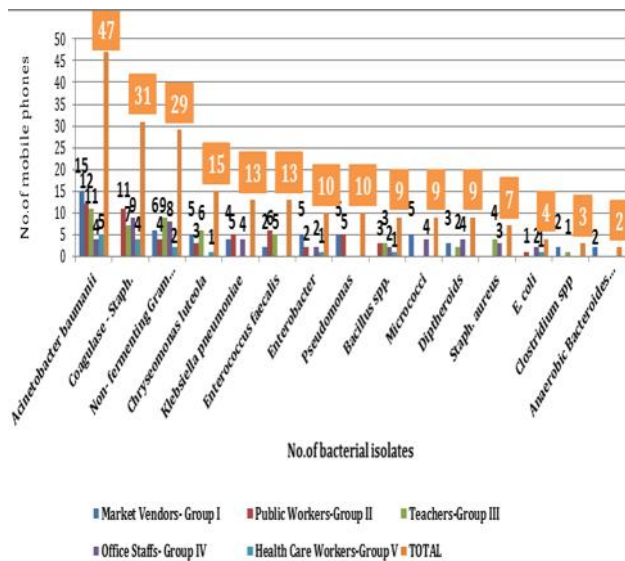
**Fig.2:Frequency distribution of bacterial isolates**
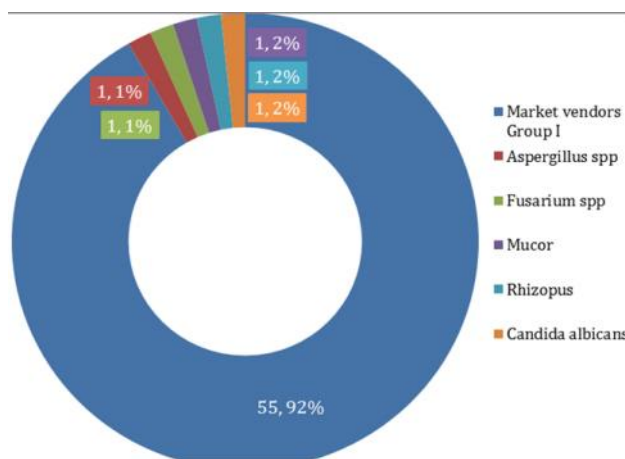
Fig.3: Fungal isolates from market vendors

Multi drug resistant pathogens isolated from the mobile phones of all five groups in this study include *Vancomycin resistant Enterococcus fecalis(2)* from Group II and III; *Gentamycin resistant Pseudomonas aeruginosae(5)* from Group I and II; *and[Extended Spectrum Beta-lactmase -ESBL] ESBL Escherichia coli(2), ESBL Klebsiella pneumonia(3)* were isolated from the Group I, II, IV.

Antimicrobial susceptibility tests for the isolates revealed that Ciprofloxacin and Third generation Cephalosporins were sensitive for most aerobic isolates (66, 35%, 55, 45%, 54, 50

%, 44, 07%, 38, 86%) (Figure-4). Metronidazole was found to be effective against anaerobic *Bacteriodes fragilis.*
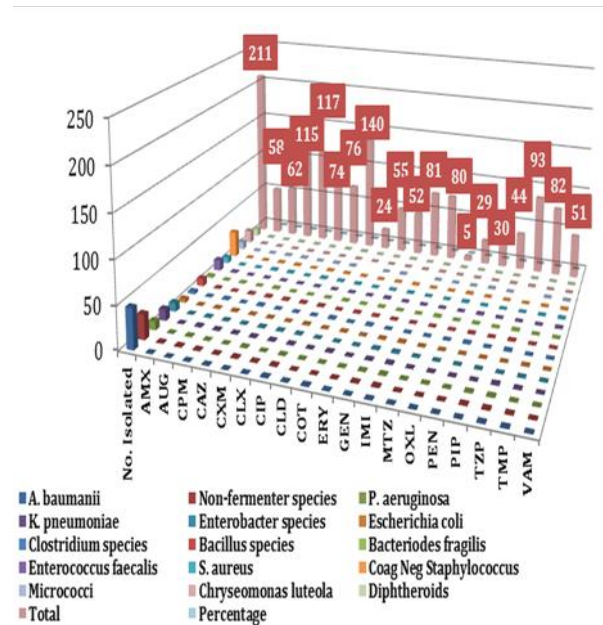
Fig.4: Percentage of Antibiotic Susceptibility of Identifed Bacterial Contamination of Mobile Phones.

DISCUSSION

For a better healthy life microbiological standards in hygiene are necessary. In the developed world the health care workers [HCWs] use their mobile phones excessively while in the hospital and the community. The threat of highly infectious pathogens is a concern. Many studies found that one third of the phones were cross contaminated through inanimate devices from HCWs to patients (Singh et al; [8]Borer et al;[9] Goldglatt et al;[7] Karabay et al;[6] Jayalakshmi et al;[4]and Sham S.Bhat et al)[13] All these research shows that an average cell phone carries more germs than a public toilet seat, and most phones are covered with nasty creatures like *Vancomycin resistant Enterococcus* fecalis, *Gentamycin resistant Pseudomonas aeruginosae and ESBL Escherichia coli, ESBL Klebsiella pneumonia, Acinetobacter baumanii,* Coagulase Negative Staphylococci, *Non fermenting Gram negative bacilli, Chryseomonas luteola, Klebsiella pneumonia, Enterococcus faecalis,*

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Enterobacter cloacae, Pseudomonas aeruginosa, Micricoccus, Bacillus spp, Diptheroids, Staphylo coccus aureus, Escherchia coli, Clostridium spp, Anaerobic Bacteroides fragilis, Candida albicans, Aspergillus spp, Fusarium spp, Mucor, and Rhizopus [These organisms shown in (**Figure2**).] these organisms not only make you sick, but also, in severe cases, can be deadly[12].

In this study, 83% of 255 mobile phones were contaminated by microbial agents. Isolation of these from electronic devices such as mobile phones, computers, key boards, have shown that these devices acts as a spread of hospital associated infection[1]. Out of the five groups (I-V) studied, Group I (54.25.5%), had the highest rate of bacterial contamination followed Group II (52, 24.6%), Group III (48, 22.7%), Group IV (42, 19.9%) and Group V (15, 7.1%). The high prevalence of bacterial agents isolated from the mobile phones of Group I, could be due to the poor hygienic and sanitary practices associated with the low level of education among markets vendors, especially those involved in handling raw meats and vegetables, compared to staffs working in a hospital environment, Group V where there is a regular disinfection. The health care workers contamination is less compared to all other groups; It reveals that in a developing countries like Saudi Arabia the frequent hand washing and disinfection with 70% alcohol rub is mandatory in this hospital and the use of mobile phones during working hours also strictly prohibited specially in the areas like Radiology, laboratory, ICU and OR.[4-7]

Mobile phones have a great role in disease transmission such as diarrhoea, respiratory infections, fungal infections like Non invasive Candidiasis, Otomycosis, disseminated Aspergillosis and Zygomycosis (Mucor-Rhizopus) and viral Hepatitis A, B, C, and D all these infections are widely spread through hand to mouth, nose, ears etc. 83% of this contamination reveals that our hands are the best source of contamination. This study has

made it essential that frequent hand washing be accomplished and maintained [3]. Wide use of mobile phones are hazardous to the persons health, hearing loss, neck pain and constant use lead to numbness due to radiation effects [4]. In this study, the use of mobile phones from five different groups of people highly contaminated with drug resistant bacteria it can be gradually transmitted to any areas of the human groups from the market place in public, teachers, office staff, and health care workers. *Acinetobacter baumanii* (47, 22.2%) was the most prevalent bacterial isolate among the gram negative bacilli. It is interesting to note that there was no statistical significant difference (P >0.05) in the occurrence of *Acinetobacter baumanii* the pathogenic bacterial agent isolated in the mobile phones of all the study groups **(Figure-2)**. This finding corroborates with the findings from a study from Israel, where *Acinetobacter* was the predominant isolate recovered from cell phones Borer et al;[9]. When exposed to sunlight most of the bacterial agents die due to dehydration, but *Acinetobacter* and

S. aureus are survive for weeks and multiply rapidly in a warm environment Kramer et al;[14.] A similar study in Israel identified a multi drug resistant *Acinetobacter baumanii* on the hands. Cell phones of health care workers and patients in hospital, especially in ICU, OR, other areas banned the use of mobile phones. It could reduce miscommunication, medical errors and transmission of infectious agents. A recent randomized controlled trial found that the unrestricted visiting hours on an intensive care unit did not reduce the risk of infections.

Antimicrobial sensitivity testing revealed that over 66% of the isolates were susceptible to Ciprofloxacin, third and fourth- generation Cephalosporins. Other antibiotics evaluated in this study ranged between 29.38% to 38.38% efficacy (Figure-4). However the vancomycin resistant *Enterococci,* Gentamycin resistant *Pseudomonas aeruginosae, ESBL E.coli and ESBL Klebsiella pneumoniae* of public workers,

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market vendors and teachers had been documented.

xIn Saudi Arabia, being a developing country, disinfections guidelines are widely used and practices are strictly followed in hospitals and shopping malls. Bacteria is likely high such as hospitals, lecture halls, animal slaughter areas, canteens, shopping malls, toilets, and other public places is difficult and are hence advised to use of antimicrobial. But especially in hospital premises a strict adherence to infection control, such as hand washing with good hygienic practice is advocated. (Site: Mobile Hygiene.org).

CONCLUSION

In this study reveals the cleaning of mobile phones was much effective in reducing the microbial contamination to avoid cross infections. More and more studies are required to improve the adherence and the practice of hygienic methods. The non-corrosive antibacterial products should be introduced; it will encourage everyone to wipes the mobile phones when visibly soiled. In this data we found 20 bacterial and fungal isolates, further such viral studies surely will help the community or hospitals alert the use of mobile phones which is in close contact. In hospitals the use of mobile phones during working hours should be strictly prohibited.

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