

Mobile phones: What lies beyond the naked eyes

Abstract:

Mobile phone is one of the most purposeful usable gadgets globally, now a day. Especially smart phones are used mainly by the people most frequently. In 2017, the number of smart phone users in Malaysia is estimated to be 19.9 millions. This study is aimed to find out the rate of prior chances of spreading infections by the mobile phones in distinguished wards inside the hospitals, than that of its' toilet seats. 50 officials of Sarawak general hospital are chosen from their different wards, frequency of using smart phones are assessed by questionnaire. Then the smart phones are collected for bacteriological testing in a virology lab. For confirming bacterial growth several tests are performed like: colony morphology, gram reaction, coagulase and catalase test and antibiotic sensitivity for five different antibiotics namely Methicillin (MET5), Penicillin G (P10), Oxacillin (OX1), Chloramphenicol (C30) and Erythromycin (E15) for all staphylococcal isolates was done by Kirby Bauer disc diffusion method. Bacterial strains and its growth are observed accordingly of different zone workers and conclusions are extracted from it, as vigorous usage of mobile phones at healthcare units may cause several type of infections of gram negative as well as gram positive strain of bacteria.

Introduction

Mobile phones have become indispensable in our everyday life. Popular Mechanics magazine in one of its poll had named the mobile phone as the number 1 gadget that has changed the world. In 2017, the number of smart phone users in Malaysia is estimated to be 19.9 million (2). In the health care setting, mobile phones are used as a means of communication between co-workers and for quick references. This has greatly enhanced the ease of communication and the transfer of data between the various interdepartmental disciplines.

Hospital acquired transmission of infection and multi-drug resistant organism is on the rise which cost the country millions of ringgit every year to combat and have now reached a worrying level in some hospitals.

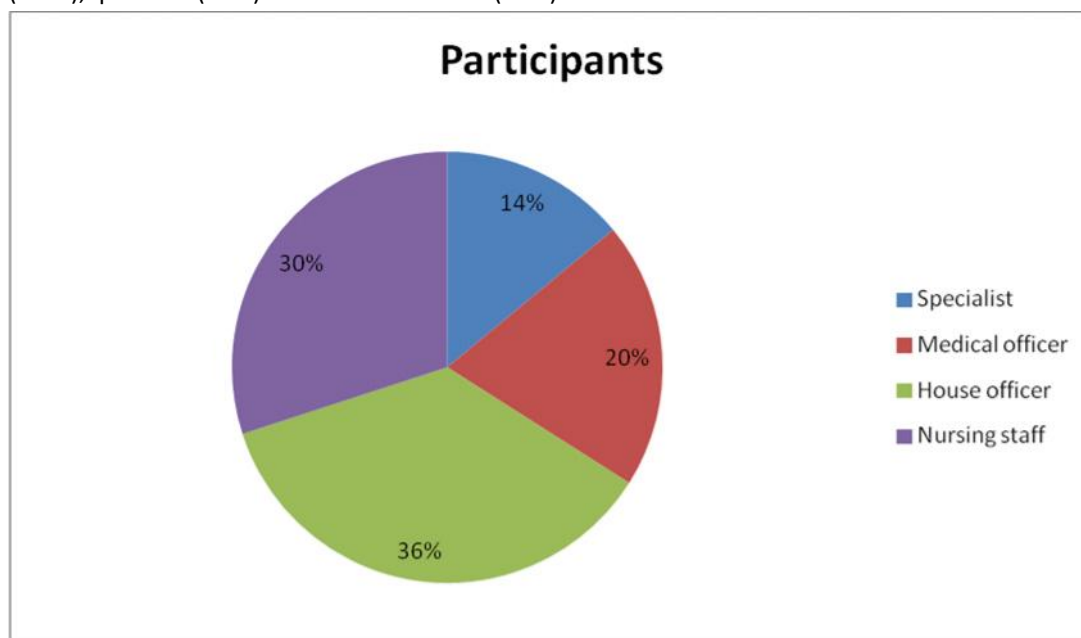
In a recent study for Time Health Magazine, scientists at the University of Arizona have found that cell phones carry 10 times more bacteria than most toilet seats(3). This begs the question, how clean are our handphones and are our handphones a source of these dreaded organisms? The possibility of mobile phones as vectors of infection hasn't been researched before in Sarawak, Malaysia. This study's objective is to determine the type of organisms/pathogens isolated on the mobile phones of health care workers from a cross section of Orthopaedic Department, Sarawak General Hospital,

Material and Method

50 random participants was chosen from health care workers in the three orthopaedic wards (male orthopaedic, female orthopaedic and paediatric orthopaedic ward) of Sarawak General Hospital who had direct contact with patients care. Verbal consent was taken and a short questionnaire given to them without previous information about the study being provided to gauge the extent of usage, general awareness of disinfecting their phone and when do they perform hand hygiene. Participants were volunteers and answered anonymously and they all agreed that the mobile phones

43 they used could be sampled for data purposes. Subsequently, the mobile phones were swabbed with
 44 a cotton swab soaked in sterile normal saline over the front, sides and back aspect of the
 45 handphone using the same cotton swab. For mobile phones with covers, the front cover will be
 46 swabbed instead. The entire procedure was performed by a clinical microbiologist using sterile
 47 gloves. This study took place in the month of February 2018.

48 Distribution of samples taken from the participants - House officer (36%), Nursing staff
 49 (30%), Specialist (14%) and medical officers (20%)

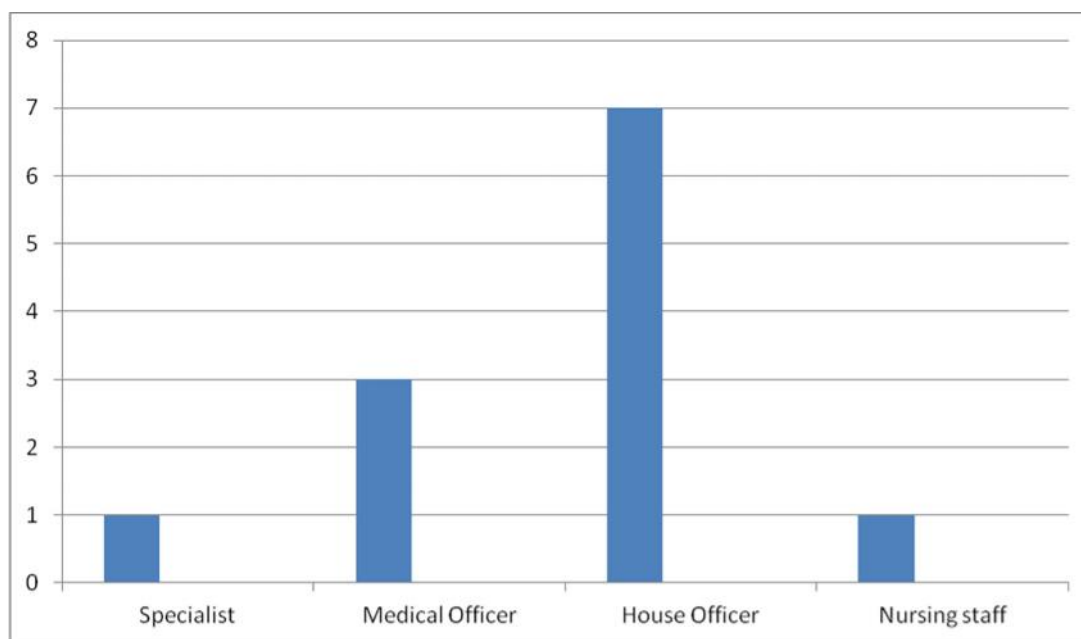


53 The study was approved by the ethics committee and the clinical research centre.

54
 55 Sample collection and processing was done by a clinical microbiologist to avoid bias. All the samples
 56 that were taken using a sterile cotton swab soaked in sterile saline over the mobile phones were
 57 stored in a Stuart medium using Bijou bottles prepared sterile by the microbiology lab of Sarawak
 58 General Hospital. All the samples taken from Sarawak General Hospital were then transported to the
 59 microbial lab in University Sarawak Malaysia (UNIMAS) for analysis. After that, the samples were then
 60 streaked on 2 separate plates - blood agar and MacConkey. Subsequently, they were examined for the
 61 growth of microorganisms and the identification was made on the basis of colony morphology, gram
 62 reaction, coagulase and catalase test and antibiotic sensitivity for five different antibiotics namely
 63 Methicillin (MET5), Penicillin G (P10), Oxacillin (OX1), Chloramphenicol (C30) and Erythromycin (E15)
 64 for all staphylococcal isolates that was done by Kirby-Bauer disc diffusion method.

65 Results

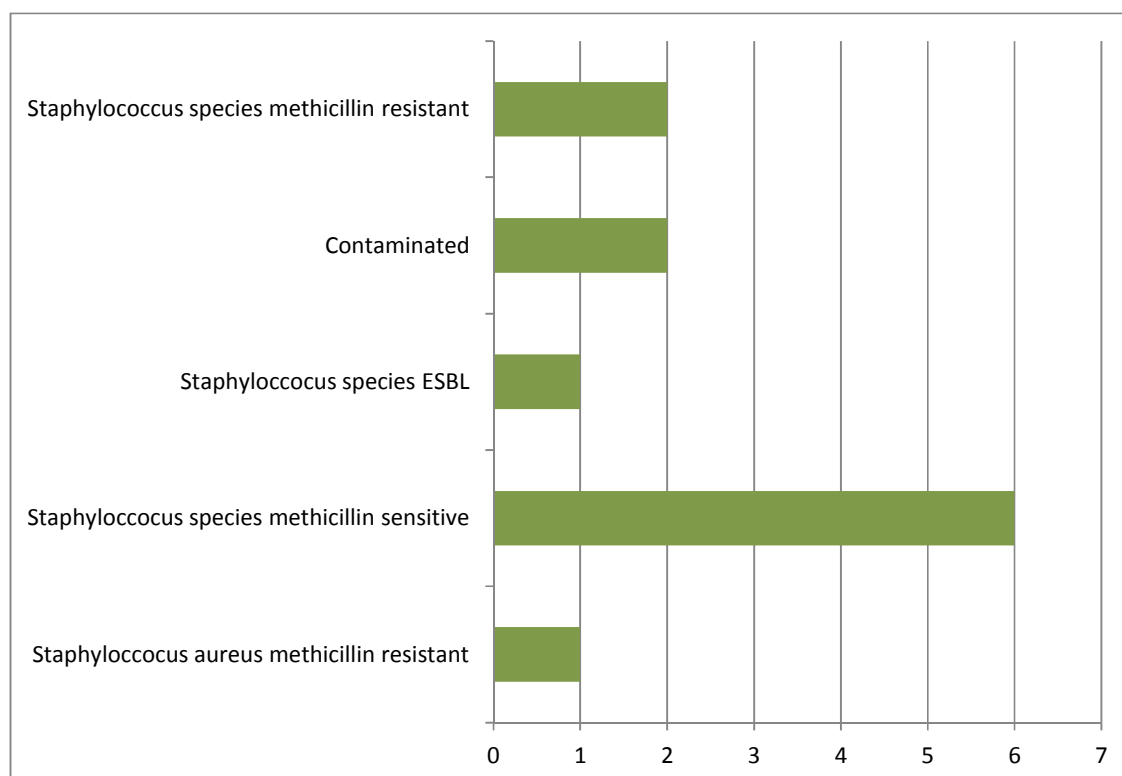
66 Out of the 50 mobile phones swabbed, there were 12 mobile phones that had growth of
 67 microorganism (24%).



68

69

70 From the 12 mobile phones,house officers had the highest rate of contamination(38%) ,followed by
71 medical officers(30%) ,(14%)and(7%) respectively for nursing staff and specialist.

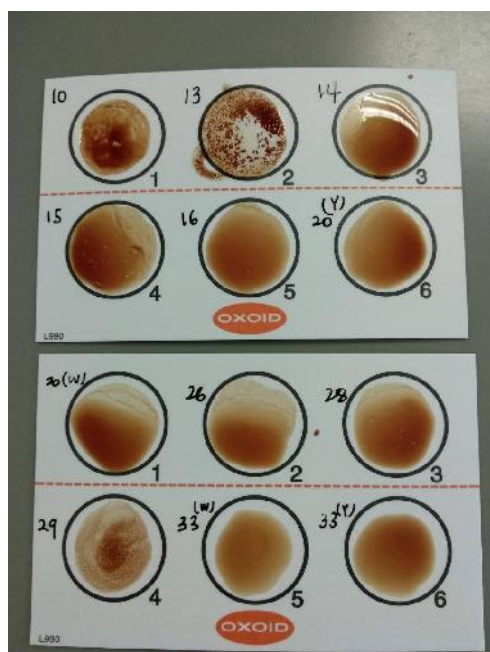


72

73

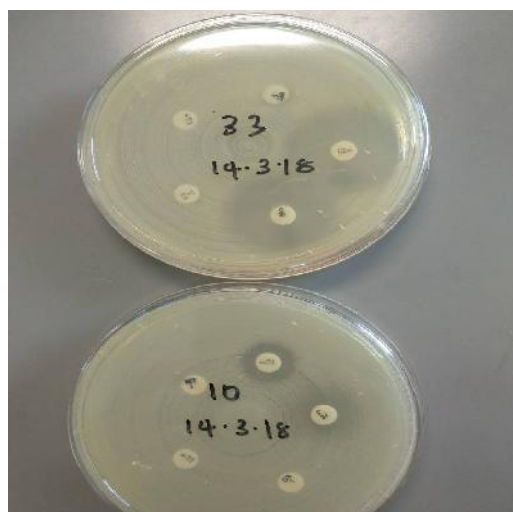
74 Among the types of bacteria cultured,2 (17%) was gram negative but cultured fungal ,and 10(83%)
75 was gram positive bacteria.From the 10,one was methicillin resistant staphylococcus aureus,one was
76 staphylococcus species extended spectrum beta lactamase ,2 more were coagulase negative

77 staphylococcus species resistant to methicillin and the remaining 6 were staphylococcus species
78 methicilin sensitive .
79
80



81
82 Figure 1:Plate numbers that had growth of microorganism
83

84



85
86 Figure 2-Examples of antibiotic testing done using disc diffusion
87

88 From the questionnaire,the majority of participants were females 64% compared to male colleagues
89 36%.More than half of the participants(58%) do disinfect their mobile phones more than once per
90 week compared to 10% who never done it.The most common practise is to clean it after hand
91 hygiene 52% and the most common disinfectant used is alcohol swab (40%).

Besides that, 66% of the participants do hand hygiene before and after handling a patient. The majority of health care workers agree that regularly disinfecting their mobile phones is necessary and that cross contamination does decrease by regularly practising this habit of disinfecting the mobile phones.

The rest of the questionnaire are shown below in Table 1

Question 1-Current Grade

Specialist	7
Medical Officer	10
Nursing staff	15
House officer	18

Question 2- Years of service in the hospital

Less than 2	22	44%
2 to 5 years	6	12%
6 to 10 years	13	26%
More than 10 years	9	18%

Question 3- How recent is the age of your current mobile phone?

Less than 1 month	2	4%
1 to 6 month	12	24%
6 to 12 month	8	16%
More than 12 month	28	56%

Question 4

How often do you clean your mobile phone?

Never	5	10%
Once a week	29	58%
Once per day	5	10%
More than once per day	3	6%
Other answers- occasionally	8	16%

Question 5

What time of disinfectant do you regularly use on your mobile phone?

Alcohol swab	20	40%
Tissue with tap water	12	24%
Clorhexidine	2	4%

Never	4	8%
Other answers AnB	8	16%
AnC	3	6%
BnC	1	2%

113

114 Question 6

115 When do you perform hand hygiene?

Never	-	
After contact	12	24%
Before contact	5	10%
Other answers-BnC	33	66%

116

117

118 Question 7

119 Do you wear any other equipment on your hand?

120

Yes	23	46%
No	26	52%
Not answered	1	2%

121

122

123 Question 8

124 In your opinion,do you think regularly disinfecting your phone is necessary?

125

Yes	48	96%
No	1	2%
Unsure	-	
No answer	1	2%

126

127 Question 9

128 Do you think corss contamination and hospital acquired infection will decrease with regularly
129 disinfecting your mobile phones?

Yes	40	80%
No	1	2%
Unsure	8	16%
No answer	1	2%

130

131

132

Discussion

Nosocomial infection has always been a burden to the health care setting. There are many possible ethiological sources as to how it was transmitted in the first place and we tried to deduce it from the mobile phone of health care workers.

In our study 24% of mobile phones of health care workers were contaminated which were similar to the study from Manglore by Khivsera *et al* who has reported lesser contamination rate of the hands of HCWs (30%). Another study from Nigeria by Akinyemi *et al*. reported HCWs to be the least contaminated (15.3%).

The most common organism as expected would be the gram positive staphylococcus which is present on the skin surfaces of humans. This was already predicted as it is a normal skin flora present on the superficial layers of skin.

From the 12 participants that had positive growth, we noticed that the longer a health personnel is in the ward, the more likely is the phone contaminated. This can be explained as the highest number of contamination was under the houseman group who typically work in the hospital ward from between 8-10 hours while the lowest was the specialist group. The duration of a mobile phone does not seem to correlate with the degree of contamination which was shown in our study whereby people who recently just used their mobile phone less than 1 month had a 25% chance for contamination in comparison to those that had their mobile phones more than 12 months had a similar contamination rate at 32%.

In terms of the best disinfectant, those that used the clorhexidine swab had the highest rate of contamination on their mobile phones while the lowest were those that used alcohol wipes.

Besides that, of note is that the MRSA grew when the healthcare worker had never cleaned or disinfected the mobile phone before while the other methicillin resistant coagulase negative staphylococcus species grew even though they regularly disinfected their mobile phones.

CONCLUSION

In this study, we concluded that pathogenic bacteria that is notorious for nosocomial infection does harbour in the mobile phones of our health care workers and urgent guidelines or protocols should be established to circumvent it. We can also deduce that while there are no proper guidelines had been issued by the infectious disease department of our hospital, the majority of health care workers do disinfect their mobile phones on a regular basis whereby health care workers 80% do clean their mobile phones while only 20% don't.

Mobile phones are here to stay due to its numerous benefits and concerted efforts should be implemented. Simple measures such as proper hand hygiene practices and regular decontamination of the mobile phones with alcohol wipes may reduce the risk of hospital acquired infection caused by these devices.(5)

173 **References**

- 174 1 <http://www.govtech.com/products/How-Smartphones-Revolutionized-Society-in-Less-than-a->
175 Decade.html
- 176 2 <https://www.statista.com/statistics/558698/number-of-mobile-internet-user-in-malaysia/>
- 177 3 <http://time.com/4908654/cell-phone-bacteria/>
- 178 4 Omololu-Aso J, Kolawole DO, Omololu-Aso OO, Ajisebutu SO. Antibiotics sensitivity pattern
179 of *staphylococcus aureus* from fomites in the Obafemi Awolowo University Teaching Hospital
180 Complex Nigeria. Int J Med Med Sci. 2011;3:32–6
- 181 5 Jeske HC, Tiefenthaler W, Hohlrieder M, Hinterberger G, Benzer A Anaesthesia. 2007 Sep;
182 62(9):904-6