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Pathogen Carrying Capacity of Mobile Phones of Health Workers in a Teaching Hospital

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ABSTRACT

Mobile phones have become indispensable accessories of professional and social life. Micro-organisms that cause hospital acquired infections can be transmitted by handheld devices of hospital personnel. Studies have shown that mobile phones could be a health hazard with tens of thousands of microbes living on each square inch of the phone. This study determined the prevalence of micro-organisms on the mobile phones of health workers and their role as a source of hospital acquired infection.

The study utilised a cross-sectional design. A total of one hundred and eighty swabs were collected from the mobile phones of health workers and subjected to microbiology analysis.

Microbes were cultured in 70% of cell phones, 5% of which had mixed growths. Staphylococcus aureus accounted for 28%, coagulase negative staphylococcus 31% and E. coli 3% of the cultured organisms. Over 90% of Gram positive organisms were sensitive to Gentamicin while 70% of gram negative organisms were sensitive to Gentamicin. Two-fifth of gram positive and one-tenth of gram negative organisms were sensitive to Co-trimoxazole while neither was sensitive to Ampicillin. Only 42% of our respondents disinfect their mobile phones.

Health workers should be sensitized on the need to disinfect their mobile phones regularly.

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INTRODUCTION

Healthcare-associated infection (HAI), otherwise called nosocomial infection is a major but often neglected public health problem in both developed and developing countries[1]. The World Health Organization (WHO) defines HAI as an infection acquired in a hospital or other healthcare facility by a patient in whom the infection was not present or incubating at the time of admission. This includes infections acquired in the hospital but appearing after discharge, and occupational infections among staff of the facility.[1] Reports indicate that at any one time, more than 1.4 million people worldwide are estimated to suffer from infections acquired in hospitals.[1,2] The estimated rate of HAI ranges from 25% to 40% and exacts a tremendous toll on patients, families and systems of care, resulting in increased morbidity and mortality, and increasing the cost of healthcare[1].

Mobile phones are increasingly becoming an important means of communication in Nigeria. Being inexpensive and conveniently small in size, they are used by patients, doctors and other health care workers (HCWs) in a hospital for immediate communication during emergencies, in ward rounds, in operation theatres and intensive care units.[3,4] They may serve as mobile reservoirs of infection allowing the

transportation of the contaminating bacteria to many different clinical environments.5 Furthermore, sharing of mobile phones between HCWs and non HCWs may directly facilitate the spread of potentially pathogenic bacteria to the community. Various objects like stethoscopes, patient's file, bronchoscopes and ballpoint pens have already been reported as vectors for potentially pathogenic microorganisms from HCWs to patients. The potential of cell phones as vectors to nosocomial pathogens has been studied previously[3,4,5] and revealed that Coagulase Negative Staphylococcus (CONS) a part of normal skin flora as the most commonly isolated. Potentially pathogenic bacteria found were methicillin sensitive Staphylococcus aureus (MSSA), coliforms, methicillin resistant Staphylococcus aureus (MRSA), Corynebacterium spp., Enterococcus faecalis, Clostridium perfringens, Klebsiella spp., Enterobacter spp., Pseudomonas spp., Aeromonas spp, Acinetobacter and Stenotrophonmonas maltophilia.[3,4]

A research done in a hospital in Turkey found out that about 95% of mobile phones were contaminated with bacteria and that these mobile phones could act as a reservoir for infection-.6 Researchers have shown that mobile phones could be a health hazard with tens of thousands of microbes living on each square inch of the phone--.Thus, mobile phones have the potential to cause hospital acquired infections with possibility of increase morbidity and mortality and also extra length of stay in the hospital.[5]

There are very few reports on the role of mobile phone in the spread of hospital acquired infection especially in the tropical setting and particularly Nigeria. Since mobile phones are used both inside and outside the hospital, it could also serve as a pathogen carrier into the community.

The objectives of this study were to assess the prevalence of microbes on mobile phones of health workers and to assess the role in nosocomial transmission.

Methods

The study which was a descriptive cross sectional study design carried out at the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), Ile-Ife located in Ife Central Local Government Area of Osun State between the months of June and July 2012. It is the largest Local Government Area in Osun State with a total population of 167,204. OAUTHC is the only teaching hospital in the local government. Sample size was calculated using Windows program for Epidemiologist (WINPEPI) for calculating simple proportion with level of confidence set at 95%, degree of precision at 0.05 and Prevalence of mobile phones positive for microbes 86%.[7] A sample size of 186 was obtained and 180 respondents were interviewed. A two stage sampling procedure was used, at the first stage the health workers were stratified by occupation and at the second stage they were randomly selected using sample proportionate to size from a list of health workers obtained from the administration department of the hospital. The data was collected with the use of self administered questionnaire which consisted of four sections comprising bio data, awareness of hospital acquired infection, hand held devices as causes of HAI and hand washing practices of health workers. The samples were collected from mobile phones by using a sterile swab moistened with sterile water rotated over the back of mobile phones. The samples were

transported immediately to the medical microbiology laboratory for laboratory analysis. The swab specimens were immediately streaked into Mac Conkey and Blood agar. The inoculated media were incubated aerobically at 370C and Carbon dioxide respectively for 24hrs. All isolates were characterised using schema of Cheesebrough[8] and Cowan[9].

Susceptibility to antimicrobial agents was tested by using disc diffusion method using Diagnostic Sensitivity (DSTA). The antimicrobial agents used in the test include: Eryrthromycin (10g), Gentamicin (10g), Nalidixic acid (30g), Ceftraxon (30g), Cloxacillin (5g), Tetrarcyclin (25g), Amoxicillin (25g), Cotrimoxazole (25g), Chloramphenicol (30g), Oflaxacin (30g). Sensitivity to each antibiotic was interpreted as recommended by Lorian.[10]

The data were analyzed using the Statistical Package for Social Sciences version [16](SPSS 16) software. Discrete variables were presented with the use of tables and charts and bi-variate analysis to test association was done using chi-square with level of significance at <5%. Ethical clearance was obtained from the Ethics committee of the Institute of Public Health, Obafemi Awolowo University, Ile-Ife. Informed consent was obtained from the respondents and confidentiality assured.

Result

The socio demographic information of respondents is presented in table I. About one third (35%) respondents were aged between 20-29years, while 42% were aged between 30-39years. Half of the respondents had work experience of more than 5 years. Male respondents were 51.1% while the females were 48.9%. In addition, over 80% respondents were Christians, 45.6% were Nurses while Doctors were about 37%.

About 97% of the respondents had heard of

Table I: Socio-demographic Characteristic of Respondents

VARIABLE	FREQUENCY(N= 180)	PERCENTAGE
Age		
20-29	67	35.6
30-39	77	42.8
40-49	25	13.9
⩾50	11	6.1
Sex		
Male	92	51.1
Female	88	48.9
Religion		
Christianity	150	83.3
Islam	25	13.9
Traditional	1	0.6
No Response	4	2.2
Occupation		
Doctor	66	36.7
Nurse	82	45.6
Lab scientist/Technician	20	11.1
Administrative staff	12	6.7
Years of experience		
<2yrs	50	27.8
2-5yrs	40	22.2
>5yrs	90	50.0

Table II: Awareness of Hospital Acquired Infection

Variable	Frequency(N=180)	Percentage
Ever heard of hospital acquired infection?		
Yes	175	97.2
No	5	2.8
Sources of information		
Radio	56	31.1
Television	63	35.0
Newspaper	63	35.0
Seminar	159	88.3
Internet	91	50.6
Others	3	1.8

Table III: Knowledge on Mode of Spread

Variable	Frequency(N=180)	Percentage
Contact with patient	171	95.0
Contact with body fluid	155	86.1
Handshake with health worker	124	68.9
Carriage in apparels	149	82.8

Table IV: Perception on Transmission of Infection via Hand Held Devices

Variable	Strongly Agree	Agree	Disagree	Strongly disagree	No Response
Through cell phones	58(32.2)	104(57.8)	6(3.3)	6(3.3)	6 (3.3)
Through biro/pencils	60(33.3)	97(53.9)	9(5.0)	7(3.9)	7 (3.9)
Through handbag	43(23.9)	100(55.6)	23(12.8)	5(2.8)	9(5.0)
Through stethoscope	88(48.9)	76(42.2)	6(3.3)	2(1.1)	8(4.4)
Through tape measure	72(40.0)	79(43.9)	18(10.0)	3(1.7)	8(4.4)

hospital acquired infection and most of them got the information through seminar 88%, another 50% through the internet and those who heard from television and newspaper were 35% (table II).

About 95% of the respondents believed hospital acquired infection occurred through contact with patient, while 86% through contact with body fluid, and about 83% through carriage in apparels as shown in table III.

About 90% of the respondents agreed that the transmission could occur through mobile phones and through stethoscope another 86% through biro / pencils, 83% through tape measure and about 78% through handbag as shown in table IV.

Table V: Proportion of Respondent that enter the Ward with Handheld Device

Variable	Frequency(N=180)	Percentage
Disinfect phones regularly	75	41.7
Disinfect with chlorhexidine (n=75)	30	40.0
Disinfect with methylated spirit (n=75)	60	80.0
Disinfect with hand sanitizer(n=75)	30	40.0

Table VI: Proportion of Respondent that Disinfect Phones and what they Disinfect with

Variable	Frequency(N=180)	Percentage
Wash hand before seeing patient	126	70
Wash hand after seeing patient	173	96.1
Wash hand with water alone	22	12.2
Wash hand with soap and water	127	70.6
Wash hand with hand sanitizer	47	26.1
Wash hand with all above	105	58.3
Spend more than 15secs washing hand	163	90.6
Frequency of hand washing		
Always	62	34.4
Sometimes	87	48.3
Rarely	17	9.4
Never	6	3.3
No response	8	4.4

Table VII: Hand Hygiene Practices

Variable	Frequency(N=180)	Percentage
Positive cell phone culture	125	69.5
Organisms cultured		
Staphylococcus aureus	51	28.3
Coagulase -ve staph	55	30.6
Yeast cells	2	1.1
Esherichia coli	6	3.3
Shigella dysenteriae	2	1.1
Proteus morgani	5	2.8
Pseudomonas aeruginosa	1	0.6
Klebsiella aerogenes	2	1.1
Enterobacter spp	1	0.6

Almost all respondents brought a hand held device into the ward, over 90% bring pencil / biro and their handset to the ward, while over 60% comes with their handbag or stethoscope with just 55% bringing tape measures as shown in table V.

About 42% disinfect their phones, 80% of whom used methylated spirit while 40% used chlorhexidine and hand sanitizers (table VI).

Almost all (96%) respondents washed their hands after seeing a patient while only 70% did so just before seeing a patient, 90% of whom spent over 15secs washing their hands and about 70% used soap and water (table VII).

About 70% of mobile phones cultured showed growth of which about 35% were pathogenic. About 30% were coagulase negative staphylococcus (CONS) and 28% Staphylococcus aureus (table VIII).

Sensitivity to antibiotic discs showed that 70% of the Gram negative organisms were sensitive to gentamicin and nalidixic acid while for the Gram positive, 90% showed sensitivity to gentamicin and chloramphenicol and over 80% to streptomycin and tetracycline with neither being sensitive to ampicillin (table IX).

Table VIII: Type of Organisms Cultured from Cell Phones

Variable	Frequency(N=180)	Percentage
Positive cell phone culture	125	69.5
Organisms cultured		
Staphylococcus aureus	51	28.3
Coagulase –ve staph	55	30.6
Yeast cells	2	1.1
Esherichia coli	6	3.3
Shigella dysenteriae	2	1.1
Proteus morgani	5	2.8
Pseudomonas aeruginosa	1	0.6
Klebsiella aerogenes	2	1.1
Enterobacter spp	1	0.6

Table IX: Sensitivity of Cultured Organisms to Antibiotic Discs

Variable	Gram –ve	Gram +ve
	F (%)	**F (%)**
Ampicillin	—	—
Cotrimoxazole	2(11.8)	7(43.8)
Gentamicin	12(70.6)	82(92.1)
Nalidixic acid	12(70.6)	NA
Nitrofurantoin	8(47.1)	NA
Colistin	8(47.1)	NA
Streptomycin	8(47.1)	30(83.3)
Tetracycline	5(29.4)	48(87.3)
Chloramphenicol	1(5.9)	79(92.9)
Cloxacillin	NA	0(0)
Penicillin	NA	1(11.1)
Erythromycin	NA	35(83.3)

Table X: Relationship between Handwashing and Culture of Organisms

Variable	No growth	Growth	Statistic
Hand washing before seeing patient			
Yes	35(27.8)	91(72.2)	χ^2=0.98
No	18(35.3)	33(64.7)	p=0.32
After seeing patient			
Yes	51(29.5)	122(70.5)	χ^2=0.57
No	3(42.9)	4(57.1)	p=0.45

With regards to the relationship between hand washing and the culture, 27.8% of those who washed their hands before seeing a patient had no growth compared to 35.3% of those who did not wash their hands. Thirty percent of those who washed their hands after attending to patients had growth on their hand held devices compared to 43% of those who did not wash hands after medical procedure on patients. There was no significant relationship between hand washing before or after seeing patient and growth of microorganisms (p>0.05) as shown in table X.

Discussion

Over 90% of the respondents bring their mobile phones to the ward as compared to 84.5% of respondent reported in a study done in Ireland by Brady et al[3] which suggests that in developed and developing countries, mobile phones are becoming indispensable tool that are carried everywhere and could serve as vectors of nosocomial agents especially in the hands of healthcare workers and patients. In this study, samples from 70% of mobile phones grew organisms which is much lower than reported in another Nigerian study of 86%[7] and Brady in Ireland[3] but much higher than about 40% reported from India and Barbados [11, 12] and the 20% from Ile-Ife, Nigeria.[13] It is worthy to note, that the 20% is only for Staphylococcus aureus which could be the reason for the low rate reported in that particular study. Coagulase negative staphylococcus (CONS) was the most predominant accounting for 31% while 28.3% was Staphylococcus aureus which is similar to findings from a study in Nigeria which reported CONS of 26%[14] but lower than figures reported from Ireland of 52% [3] and 78% reported from India. [15]

Antibiotic sensitivity of the isolated organisms suggests patterns similar to other studies [13] with Chloramphenicol and Gentamicin having 93% sensitivity to gram positive organisms. This suggests that the sensitivity pattern by gram positive organisms in Nigeria is similar to those reported elsewhere [13].

The practice of disinfecting phones seems to be higher in this study as 42% of the respondents reported regularly disinfecting their phone which is much higher than a previous study from India where only 17.5% [16] and Turkey where only10% of health workers disinfected their phones. [6] Disinfection of phone might reduce the carriage rate of mobile phones as demonstrated by Sumritvanicha et al [17]but this may not be as effective as regular hand washing before and after contact with patients. Self reported compliance with hand washing before and after contact with patients in this study though not universal seems to be high 70% and 96% respectively when compared to 39% and 48% reported by Sumritvanicha et al[17]

and 9% and 51% reported by Alex-Hart et al.[18]

Conclusion

Mobile phones carry pathogenic organisms which can serve as mode of transmission of infections inside and outside the hospital. This study though limited by self reportage of hand washing practice rather than observation which could introduce desirability bias. The study documented disinfection of mobile phones is still an uncommon practice.

Health workers should be informed that mobile phones may be a source for the transmission for hospital acquired infection and efforts made to encourage optimal hand washing at critical moments and regular disinfection of phones.

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