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Health worker's mobile phone: Could it be a danger to patients' health or an innovation for health?

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Abstract

Purpose*:* The study sought to analyse the role of the mobile phones used by healthcare workers at a Private Hospital in Gweru, Zimbabwe during working hours on transmission of nosocomial infections.

Methods: The research was carried out at a Private Hospital in Gweru, Midlands Province of Zimbabwe. The study was a mixed methods research in which data was generated in two phases - qualitatively first then quantitatively. The qualitative was imbedded in the quantitative design leading to a better probability and validity of results. Twenty-five (25) health workers that use mobile phones during working hours were purposively selected for the qualitative study and their mobile phones that had been in use for six months and above were randomly selected for the quantitative part of the study. Interviews were used to collect qualitative data which was thematically analysed. The phones were swabbed and the swabs were cultured to allow identification of pathogens. The data was presented using statistical methods.

Results*:* The study revealed that healthcare workers use their mobile phones to communicate patient's condition with colleagues and superiors. They also spend time on social media and gaming. However, they do not disinfect them. The result showed that seventeen (68%) of mobile devices were contaminated with *E coli*, (75%), *Staphylococci* (38%) and *Streptococcal* (21%) which are pathogens that have a potential of causing nosocomial infections.

Conclusion: The study concluded that health workers' mobile phones can be an innovation for communicating patient's information, they also have a potential of causing nosocomial infection hence the need for surveillances of hospital acquired infections in all heath care institutions including private hospitals.

Keywords: Nosocomial; Transmission; Infection; Health-worker; Mobile phone

1. Introduction

Nosocomial infections are a problem globally, and they account for several deaths in developing and developed countries. They are infections that a patient acquires whilst admitted in a hospital and there will not be evidence of the pathogen on admission. Could the mobile phones used by healthcare workers be a source of nosocomial infections? This study sought to investigate the role of healthcare workers' mobile phones in spreading nosocomial infections.

Nearly 1,4 million instances of nosocomial infections cause around 100,000 fatalities in the United States each year, more than HIV/AIDS, cancer, and traffic accidents combined. Because of their underlying conditions, hospitalized patients are at a significant risk of infection [1]. Their risk is increased if they are exposed to certain invasive procedures or if their immunity is impaired as in transplant recipients, cancer patients receiving chemotherapy, neonates, HIV-

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positive and patients confined to intensive care units for critical illnesses [2]. In addition, patients' infectious agents can be transferred to healthcare personnel's hands and passed on to the next patient. Health-care employees are often on the phone, and they can sometimes handle patients without washing their hands properly. Healthcare workers' mobile phones are heavily colonized with bacteria that can cause nosocomial infections. As a result, most healthcare personnel have been affected by the Covid 19 epidemic because of the infected patients they would be caring for [3].

Nosocomial infections are a significant strain on Africa's health-care system. It affects 5-10% of patients admitted to normal wards and up to 50% of patients admitted to critical care units [4]). The scope of the problem is under-appreciated or possibly unknown, owing to flaws in the surveillance system caused by financial constraints. In addition, most African Hospitals suffer from overcrowding and understaffing which could lead to high prevalence of hospital-acquired illnesses, which might be exacerbated by healthcare personnel's usage of cell phones at work.

Because of the poor surveillance of nosocomial infections in Zimbabwe, many illnesses may go undetected when they occur. As a result, very little information about their occurrence and distribution is available. A cell phone is one of the most commonly utilized devices in hospitals, as switchboards are frequently unavailable due to power outages. As a result, this gadget is critical for clinical communication. Since mobile phones are handled in highly infectious conditions, infections can spread easily when they are in use [5]. As a result, in Zimbabwe, it is quite likely that the bulk of nosocomial illnesses are spread via mobile phones usage hence the need to analyse their role in the spread of nosocomial infections.

The use of mobile phones by employees at Private Hospital is high. Almost every employee has access to a smart phone. These smart phones enable a wide range of social media applications, allowing users to contact their loved ones quickly, cheaply and easily. Because they play such an essential role in the flow of information, they are becoming increasingly common in health care. Most hospitals use mobile phones to minimize operating expenses, increase staff communication, and reduce medication administration errors. Patients' notes can be photographed and emailed to their doctors, especially after hours, as well as X-rays and laboratory investigation results can now be photographed and emailed to different levels of care if patients are being referred. Using mobile phones for capturing patients' information has never been easier, faster, or more accurate. The use of these phones has also made contact with different departments much easier. When the power goes out, smart phones are sometimes utilized as torches while waiting for the main generator to come on. These personal devices provide users with access to text books, medical journals, practice guidelines and calculators they need to determine prescription dosages for individual patients [6]. On the other hand, McBride and LeVasseur [7], disagree with the above idea, claiming that personal mobile phones and other communication devices provide users with an ever-increasing variety of non-work related activities during working hours, resulting in distraction and compromised patient care as providers are distracted by these devices.

These phones are typically kept in the healthcare workers' pocket and are available at all times. Micro-organisms obtained from the environment, including patients, are carried on human hands and the health workers frequently touch their cell phones and thus most likely contaminate them. The majority of employees do not wash their hands with soap and running water to decontaminate them before treating patients or after using their phones leading to phone contamination [8]. Only proper and effective hand washing can help to reduce contamination. However, hand washing is difficult to execute thoroughly and effectively in a crowded environment, resulting in infection transmission. Bodena et al. [8], found that more than 80% of healthcare workers' mobile phones were contaminated with various diseases. The health workers' cleaning and/or disinfection of the mobile phone is debatable. According to Kortis et al. [9], most healthcare workers clean their phones at least once a week, and most doctors clean their phones multiple times a year. Medical students used dry cloths whereas other healthcare personnel alcohol-based disinfectants [9].

Because these phones are not disinfected, infection control is not guaranteed despite continuous hand washing as washed hands repeatedly touch the contaminated mobile phone, increasing the risk of hospital acquired infection. As a result, microorganisms can be easily transmitted to patients through the hands of health-workers who are constantly touching their phones [4]. Kotris et al. [9] found that coagulase negative *Staphylococci* and *Staphylococcus aureus* were the most commonly isolated microorganisms in healthcare personnel's mobile phones at Pulmonary General Hospital in Croatia. A study by Selim, [10], found that all mobile phones tested for microbes at the Alexandria University students' hospital were contaminated with mixed or single microbes, Methicillin-resistant S. aureus and coagulase-negative *Staphylococci* are the most common, accounting for 53% and 50% of cases. It therefore became paramount to analyse the role of mobile devices in spreading nosocomial infections in a private health-care setting. The objectives of study were to:

- To analyse the health workers' perceptions on use of mobile phones during working hours.
- To identify specific pathogens on the healthcare workers' mobile phones.

- To determine prevalence and total bacteria count on healthcare workers' phones.

2. Material and methods

A mixed research methodology was used in this study to gain a deeper grasp of the topic while balancing the drawbacks of employing each approach separately [11]. The use of both qualitative and quantitative research designs allowed deductive and inductive investigation to come up with valid findings. The qualitative was embedded in the quantitative research resulting in more accurate and reliable outcomes. The Sequential exploratory design was adopted for this study to gain a better grasp of an existing problem of the use of mobile phones during work and their role in spreading nosocomial infections [12]. The study was conducted in two phases. Data collected and analyzed in the qualitative phase was merged with the quantitative data in the second phase. Purposive sampling was done to obtain individuals with specific traits that the researcher requires [13]. In this case the participant had to be a health-worker with a mobile phone which they use during work hours. Purposive sampling was used to select 25 health-workers for the study (ten nurses, two doctors, three clerks, six nurse aides, and four general hands) who were interviewed using a structured interview schedule to draw out the beliefs and practices of the health-workers on the use of mobile phones as a source of nosocomial infection. The data was analysed thematically and then merged with laboratory findings from the swabs to determine the role of mobile phones.

The qualitative phase involved collecting swabs from the mobile phones of the 25sampled health-workers. Sterile swabs were used to swab the selected mobile phone of the health workers. Transport medium was used to transport them to the laboratory where culture and microscopy was done to identify any microbes on the phones.

Permission to carry out the study was sought from the private hospital as well as approval from the medical research council (approval number MRCZ/B 2225). Consent was also obtained from the participants before their involvement in the study

3. Result

The qualitative data revealed following themes;

- Healthcare workers believe that it is not a good practice to use mobile phones during working hours as it can interfere with their work
- Health workers use their phones at work despite knowing that they can spread infection
- Health-workers do not disinfect their phones

3.1. Healthcare workers believe that it is not a good practice to use mobile phones during working hours as it can interfere with their work

Analysis of health workers perceptions, thoughts and feelings on use of mobile phones showed that all (100%) of the participants knew that it is not a good practice to use mobile phones during working hours as it can interfere with their work but they use them all the same. They know that quality care of patients may be compromised as one will be concentrating on the phone instead of rendering the care to the patients. The participants had a variety of views concerning the use of mobile phones during working hours.

N1 said "*I cannot go for more than two hours without checking on my mobile phone to see new messages. Phones should not be used during work but I need to keep in touch especially with my family. I feel that it is the norm to be near my mobile phone at all times, if I fail to do so, then I will become more distracted because I will be thinking about it all the time.*

N/A 4 had this to say "*My phone is my private life and business, as long as I use it on my free time it should not be anyone's problem."*

"*The phones are a necessity during working hours, who is not using a phone in this century, I need to surf the internet if I get stuck, so my phone is the answer as we do not have access to the internet on our computers at work"* C 3

The health workers claimed that they use their phones mainly for communication during working hours. A major number (60%), of the participants use their mobile phones to access the internet and to communicate with their colleagues. The following are some of the sentiments from the participants;

"My phone is vital when I want to refer patients to specialists, they always ask for pictures of Laboratory results" D1

"I communicate with clerks to get clarification on medical issues when I'm faced with difficult situations." C 2

"*I use my mobile phone to communicate with doctors and my superiors when there are problems whilst I am on duty."* N5

Twenty (20) % of the participants said they use their mobile phones in order to communicate with their immediate families and relatives in cases of emergences that may occur whilst they are at work as reflected by N/A 3 who said *"I use my mobile phone whilst I am at work in order to solve problems and emergencies at home"*

However, some of the participants (10%) said that they use their mobile phones as a calculator to calculate dosages of medicines as well as to get new information related to their work.

Participant N 3 said *"1 use my phone all the time at work to research on management of uncommon conditions"* whist N 7 said *"the phone serves as a calculator especially in the paediatric ward where you need to calculate very small doses."*

The remaining ten 10% said they use their phones when they are not busy to play games and to keep them awake especially at night when most patients are sleeping as reflected by participants, G/H 1 who said "*I play lots of games like Candy Crush on my phone when I have nothing much to do especially during night shift."*

3.2. Health workers use their phones at work despite knowing that they can spread infection

It was important to assess health workers' perceptions on risks of their mobile phones being vectors of spreading nosocomial infection when used during work. The majority (88%) of health workers agreed that their phones pose a risk of spreading infection. Even though they were aware of the risks associated with the use of their mobile phones, they still used them during working hours as stated by some of the participants;

"*It is not possible not to use the phones as I am so used to it"* N 1.

"*The phone has a high risk of spreading infection but I cannot stop using it because of the advantages associated with the mobile phones' applications*." N7

"I am very much aware of the risks but I have no choice, I'm looking for a new job so any time I can be asked to do an online interview, so I check my emails all the time. I cannot afford to miss the interview. So I am not worried about the risks associated with using my mobile phone at work as the advantages outweighs the risks." N6

Twelve percent (12%) of the participants thought that the risks associated with the use of mobile phones spreading infection was minimal. They believed that germs cannot thrive on the phones because the environment is not conducive for bacteria growth;

, "*I don't believe that any bacteria will thrive on mobile phones, because I was taught at high school that bacteria grow where there is warmth and moisture, my phone is always dry and cold"* G/H 1

"*The rays emitted by the phone will kill the microbes instantly*" N/A3

3.3. Disinfection of the phones

The health workers were assessed on disinfection of their phones to asses if the participants were aware of the possibilities of their phones being vectors of micro-organisms. The frequency of doing so is shown in Table 1

Table 1 Disinfection of the Phones N=25

Frequency of disinfecting mobile phones	Frequency	Percentage
Always.	0	0%
At end of shift	0	0%
Once a week	0	0%
Occasionally	5	25%
Never	20	75%
Total	25	100%

Most of the health-workers (75%) never disinfect their mobile phones at all whilst twenty-five (25%) do it only if the phone is contaminated with clinical waste. They disinfect it using methylated spirits and cotton wool. Some of the participants had this to say;

"*The phones are very expensive to buy, so if it is damaged by these disinfectants then I won't be able to purchase another one*" N/A 2

"I'm always so tired that disinfecting my phone is not a priority, after all the proper disinfectants are not always available" lamented N10.

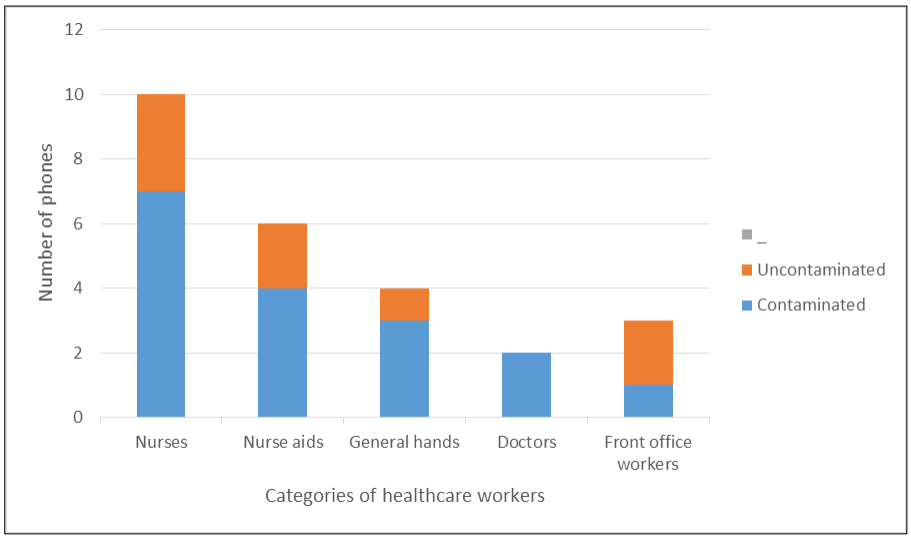
D2 asked, "Is it really practical to disinfect your phone after each use? At times, even washing my hands is not possible when the hospital is busy, I just remove a pair of gloves and put on another one very fast to do the next procedure let alone disinfect a phone."

Generally, their attitude towards disinfecting the mobile phones was very negative even though they are aware of the need to do so. The participants were really aware of the problems associated with not disinfecting the phones but they do not do it. As seventy-five (75%) of the participants do not disinfect their mobile phones, there is a high chance of the phones being vectors of micro-organisms that can be sources of nosocomial infections. This led to the second phase of data collection where the sampled phone swabs were sent to the laboratory for analysis of specific pathogens.

3.4. Quantitative Data Findings

A total of 25 mobile phones used by healthcare workers during working hours were swabbed and analysed for specific pathogens, total bacterial counts and prevalence of pathogens that can cause nosocomial infections. Of the 25 samples, 10 were from nurses, 2 from doctors, 6 from nurse aides, 3 from front officers and 4 from general hands.

Contamination was detected on 68% (17) of the mobile phones under study as illustrated on Figure 1. N=25



Source: Raw data

Figure 1 Number of Phones Contaminated by Micro-Organisms

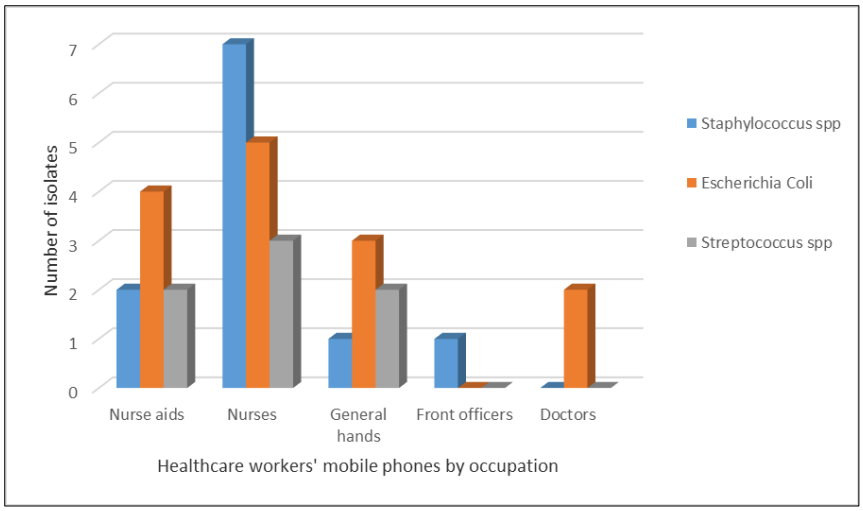
Fig 1 shows that ten (10) samples were collected from nurses, of the ten (10) samples, seven (7) were contaminated accounting for 70%. From the category of Nurse Aides, 6 samples were collected and four (4) were contaminated which is 67%. On general hands, four (4) samples were collected and three (3) were contaminated which is 75%. Two samples were collected from doctors and they were all contaminated which is 100%, then lastly three (3) samples were collected from clerks (front officers) and one (1) was contaminated which is 33%.

3.5. Specific pathogens obtained on healthcare workers' mobile phones

Determining the specific pathogens enabled the researchers to identify pathogens that has a potential of causing different types of nosocomial infections. Prevalence and total bacterial count obtained on phones enabled the researchers to determine the proportion of microbes obtained in different grades of healthcare workers that has a

potential of causing nosocomial infection. Total bacterial count will quantify the micro-organism found on the phones of the healthcare workers. The higher the bacterial count the greater the probability of the occurrence of disease.

Figure 2 showed that there were three (3) different isolates cultured on the mobile phones categorised according to respective grades of healthcare workers. N=25



Source: Raw data.

Figure 2 Prevalence and Total Bacterial Count on Healthcare Workers' Phones

As illustrated by Figure 2, 70% of the nurses' swabbed phones were contaminated and the distribution of the specific pathogens were, *Staphylococcus species* (46, 67%), E.coli (33, 33%) and streptococcus spp. (20%) of the isolates. This means that of the seven contaminated phones, two had *Staphylococcus spp* only, two had both *Staphylococcus* and *E.coli*. Then 3 phones had all the three micro-organism.

For nurse aides, four (67%) of the analysed phones were contaminated. Different isolates were obtained on the phones; E.coli (50%), streptococcus (25%) and *Staphylococcus* (25%). Of the above four contaminated phones, two (50%) had *E.coli* only and two (50%) had all three micro-organisms.

On general hands, three phones (75%) were contaminated with six different microbes: *Staphylococcus species* (16,66%), E.coli (50%) and *Streptococcus spp* (33, 34%). That is, one phone was contaminated with E. coli only, one phone had *Streptococcus* and *E. coli* and one phone had all the three micro-organisms.

On the clerks' (Front officers), 33,3%. of swabbed phones was contaminated with only *Staphylococci species* on all (100%) of the phones whereas only *E.coli* isolates (100%)were found on all (100%) the Doctors' phones.

4. Discussion

4.1. Perceptions of Healthcare Workers

From the findings, all the healthcare workers knew that it is not a good practice to use their mobile phones during working hours as it can divert their attention from rendering quality care to patients. The study findings revealed that health-workers play games on their mobile phones during the night and browse the internet for entertainment. Some of the health workers claimed that they use their mobile phones when they are not bust especially during the night when patients are asleep. This cannot be justified as they can fail to hear a patient calling as they will be engrossed on entrainment from the internet [7]. According to McBride and LesVasseur [7], mobile phones and other communicating devices provides users with an ever increasing number of diversities of non-work related activities that could lead to compromised patient care In addition, the participants were also aware that concentrating on their mobile phones could lead to poor communication with patients as they will be concentrating on their phones with a possibility of ignoring the patients. This was echoed by McBride and LesVassaseur [7], who said mobile phones create a physical barrier between users and the rest of the world hence therapeutic communication will not occur between healthcare workers and patients as they will be concentrating on their phones and ignoring patients.

On the other hand, the study revealed that use of mobile phones during working hours can be very useful for communication within the hospitals, to research on new information regarding care of the patients to calculate drug dosages as well as to totalise intakes and output of patients and to convey patients' results from one department to another or to specific doctors. They are also used by the health workers to communicate with their families when problems occur whilst they are at work as stated by one participant. The findings are supported by Vearrier et al [6] who indicated that smart phones used by health workers on duty help them with access to text books, medical journals practice guide lines and calculators needed to calculate dosages of medications. However, McBride and LesVasseur [7] disagrees with the above idea and said personal mobile phones provides users with an ever increasing number of diversity of non-work related activities during working hours which could lead to compromised patient care. As a result, mobile phones should always be checked to see if there are any scheduled interviews that can be missed if mobile phones are not used during working hours as stated by one participant stated in this study.

The study findings proved that mobile phones are not being disinfected. All (100%) participants in this study even though they are fully aware of the risks involved do not disinfect their phones. Their reasons being that phones can be damaged by disinfectants, most likely bacteria cannot thrive on mobile phones as they are always dry and cold, bacteria favours to grow on warm and moist areas as taught at high schools. In contrast to the findings, one study showed that most healthcare workers cleaned their phones at least once a week, medical doctors several times a year [9]. However, this is not adequate considering the fact that a hospital is a source of nosocomial infections. The problem of not disinfecting phones is compounded by poor hand hygiene which can lead to phones being contaminated and this needs to be addressed. This is supported by Bodena et al [8] who stated that the majority of workers do not wash their hands with soap and water before handling patients and after using their mobile phones which could lead to the spread of nosocomial infections.

4.2. Specific Pathogens obtained from healthcare workers' phone

The findings proved that the mobile phones of health workers are a potential threat their health, health of the patients and even the families of the health worker as laboratory culture revealed three different types of pathogens isolated from the phones. These are E. coli which was widely distributed with 44%, followed by Staphylococcus species contributing to 34% and Streptococcus being the least common micro-organism detected contributing to 22%. These findings were supported by a study which identified E. coli as being one of the major leading member of the Entero-bacteria found on most phones [10]. These micro-organisms are most likely transmitted to the phones through contaminated hands and the environments in healthcare settings as the findings in this study reveal that the phones are not disinfected.

According to the results of this study, all groups of the healthcare workers' phones studied were contaminated with micro-organisms. This therefore implies that mobile phones used have a potential of causing nosocomial infections. This was echoed in a study done by Selim [10] who found that mobile phones used during working hours by health workers were contaminated by bacteria. Whilst study found *E.coli* to be the most common pathogens on the phones, Asfaw et.al [14] identified *Staphylococci* as the most common pathogen contaminating phones with S. aureus 20% and coagulase negative *Staphylococci 76%.*

The study done at the Private Hospital demonstrated that mobile phones used by health workers harbour microorganisms as seventeen (17) out of twenty-five (25) studied phones were contaminated which accounts for sixty-eight percent (68%). Further research is warranted to fully assess the risk posed by the bacteria isolated.

5. Conclusion

From the research findings, it can be concluded that mobile devices used by healthcare workers at the Private Hospital are a source of nosocomial infections as 68% of the health-workers' phones were contaminated with pathogens. In addition to this, the healthcare workers do not disinfect their phones yet they use them most of the time in the clinical areas. The hands of these workers have a potential pivotal role of transmitting the micro-organisms to susceptible admitted patients. However, the same phones are a necessary technology that enhances communicating health information between health workers hence there is a need for a hospital policy on the use mobile phones at work and a safe disinfectant to disinfect the mobile phones.

Compliance with ethical standards

Acknowledgement

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Disclosure of conflict of interest

Both Dr Tsitsi Panganai and Primrose Hamadziripi declare no conflict of interest.

Statement of ethical approval

The research work does not contain any studies performed on animals/humans subjects by any of the authors.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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