

SENSITIVITY PATTERN AND CORRELATION OF ORGANISMS ISOLATED FROM THE HANDS AND MOBILE PHONES OF PERSONS IN HEALTHCARE SETUP

JAY RABINDRA KUMAR SAMAL¹ & SHASHI CHOPRA²

¹Student, Department of Biotechnology, Manipal Institute of Technology, Manipal, India

²Professor, Department of Microbiology, Punjab Institute of Medical Sciences, Jalandhar, Punjab, India

ABSTRACT

Introduction: The human skin hosts a wide variety of microorganisms which have important effects on health, with a typical hand surface harboring more than 150 bacterial phylotypes. The hospital environment serves as a reservoir for nosocomial pathogens as these pathogens can survive on environmental surfaces for months. Thus, the hands as well as the skin and clothing of the hospital staff are at an undue risk of contamination. When mobile phones are used, they have direct contact with the human skin and thereby exposure to both the normal flora and pathogenic organisms on the hands. This contamination can serve as the source of pathogens on mobile phones, leading to the prevalence of hospital acquired infections. Nosocomial infections affect 1 in 10 patients admitted to hospitals which are caused by multi drug resistant organisms due to the repeated and improper use of antibiotics.

Aim: This study is being carried out to correlate and study the sensitivity patterns of the organisms isolated from the hands and mobile phones of persons in the healthcare setup.

Materials and Methods: Samples were collected from the hands and mobile phones of 204 healthcare workers working at Punjab Institute of Medical Sciences, Jalandhar over a period of 2 months. The subcultures were streaked onto Blood Agar and MacConkey Agar plates. These plates were incubated aerobically at 37°C for 48 hours. The plates were observed for growth and organism was identified by noting the colony character, Gram's staining and biochemical reactions. The isolated organisms were screened for sensitivity to various antibiotics.

Results: From the samples of the 204 individuals, 313 organisms were obtained. Of these, 113 organisms were isolated from mobile phones, 166 organisms were isolated from the hands and contamination was obtained in 34 cases. The growth of one type of organism (51) was obtained on the hands and mobile phones of 51 (25%) subjects. In 22 (11%) cases, individual organisms were isolated from the mobile phones but there was no growth from the corresponding hands. Fifty six (75%) *Staphylococcus aureus* isolated were resistant to Cefoxitin. Hundred (71%) Coagulase negative *Staphylococci* isolated from hands and mobile phones were Cefoxitin resistant. Out of the 62 Gram-negative organisms isolated from the hands of the subjects, 52 (84%) were multiple-drug resistant.

Conclusion: There is a transfer of organisms between the hands and mobile phones. The isolation of multi-drug resistant organisms from both the hands and mobile phones is a cause of serious concern as the treatment of a disease caused by such organisms will be recalcitrant. Therefore, it is strongly suggested that the use of mobile phones in the healthcare setup, especially in the sensitive areas such as wards should be reconsidered. Healthcare workers are also advised to regularly wash their hands after using mobile phones to prevent transmission of diseases.

KEYWORDS: Hands, Mobile Phones, Organisms, Sensitivity

INTRODUCTION

Mobile phones have become indispensable accessories for communication in the present scenario. As of 31 January 2016, it is estimated that there exists 80.30 mobile phone connections for every 100 citizens of the Indian population.^{1, 2} Rapid advancement in technology has led to mobile phones becoming constant companions for people day and night, even culminating the need for many devices such as laptops, cameras and music players into a single device, which is probably the major reason for their widespread and ever-increasing popularity.³ For most people, cell-phone texting has become the preferred channel of communication.⁴

The human skin hosts a wide variety of microorganisms which have important effects on health, with a typical hand surface harboring more than 150 bacterial phylotypes.⁵ These bacteria include both the normal flora of the skin as well as pathogenic bacteria, generally prevalent in the surroundings. When mobile phones are used, they have direct contact with the human skin and thereby exposure to both the normal flora and pathogenic organisms.

Mobile phones are used by health workers for both professional as well as social applications in the health care setup. Studies have shown that the hospital environment serves as a reservoir for nosocomial pathogens as these pathogens can survive on environmental surfaces for months.⁶ Thus, the hands as well as the skin and clothing of the hospital staff are at an undue risk of contamination.^{7, 8} This contamination can serve as the source of pathogens on mobile phones, leading to the prevalence of hospital acquired infections. These devices are carried by the health workers to their homes, where they can lead to the dissemination of infection.

Nosocomial infections affect 1 in 10 patients admitted to hospitals. Intensive care units (ICU) have the highest prevalence of hospital-acquired infections as a result of mechanical ventilation, use of invasive procedures and their immune compromised status in the hospital setting.⁹

The organisms which cause these infections may be resistant to multiple drugs, leading to increase in morbidity and mortality and therefore increased burden on the economy.

Over the past three decades, the repeated and improper use of antibiotics has led to many bacterial strains developing multiple drug resistance.¹⁰ The development of these superbugs (multi drug resistant microorganisms) serves as a cause for serious concern as an antibiotic resistant epidemic may be lurking on the horizon. Recently, researchers in the US have reported their first case of bacteria resistant to colistin, often regarded as the last-resort antibiotic.¹¹ The analysis of the sensitivity patterns of microorganisms is thus important to keep in check the proliferation of multiple drug resistant organisms.

With the above reasoning in mind, this study is being carried out to correlate the organisms isolated from the hands and mobile phones of persons in the healthcare setup and to study their sensitivity patterns.

MATERIALS AND METHODS

This study was carried out in Punjab Institute of Medical Sciences, Jalandhar, Punjab from 23rd May to 22nd July, 2016. Two hundred and four samples were collected using sterile swabs from hands and mobile phones of adult subjects, both males and females, of varying age groups, who were randomly selected from the healthcare setup, which included both office and health workers (including doctors and para-medical staff). The objectives of the study were explained and

details such as age, gender and details about duration since last cleansing of both hands and mobile phones were obtained. The samples were initially inoculated on liquid broth medium and after 2 hours of incubation, the subcultures were streaked onto Blood Agar and MacConkey Agar plates.¹² These plates were incubated aerobically at 37°C for 48 hours. The plates were observed for growth and organism was identified by noting the colony character and doing Gram's staining to differentiate between Gram positive and Gram negative bacteria. The final confirmation of the organism was done by biochemical reaction.¹³

The isolated organisms were screened for sensitivity to the following antibiotics: Cefoxitin, Imipenem, Cefuroxime, Ceftriaxone, Cefotaxime, Amoxyclav and Cefixime.¹⁴

RESULTS

The sample group comprised of 204 healthcare workers (87 males (42.7%) and 117 females (57.3%)). (Figure 1) From the samples of the 204 individuals, 313 organisms were obtained. Of these, 113 organisms were isolated from mobile phones, 166 organisms were isolated from the hands and contamination was obtained in 34 cases.

The main organisms isolated were Coagulase Negative Staphylococcus (CoNS), Staphylococcus aureus (S.aureus) and Acinetobacter species as shown in Figure 2.

The growth of one type of organism (51) was obtained on the hands and mobile phones of 51 (25%) subjects. Of the 51 organisms, 36 (71%) were CoNS, 9 (18%) were S. aureus, 3 (6%) were Acinetobacter species, 1 (2%) was Klebsiella species and 2 were contaminants.

In 22 cases, individual organisms were isolated from the mobile phones but there was no growth from the corresponding hands.

The isolated organisms were 10 (45%) CoNS, 3 (14%) S. aureus, 3 (14%) Klebsiella species, 3 (14%) Pseudomonas aeruginosa, 1 (5%) Acinetobacter species and 2 contaminants

In 57 of the cases, the organism isolated from the mobile phones was different from those present on the hands. In 53 cases, growths of individual organisms were isolated from the hands but there was no growth from the corresponding mobile phones. The samples of both hands and mobile phones of 21 subjects did not show any growth. Overall, 74 mobile phones and 43 hands did not show the growth of any microorganism.

Thirty-five (72.9%) S. aureus from hands and 21 (77.8%) from mobile phones were resistant to Cefoxitin (Methicillin Resistant Staphylococcus aureus- MRSA) (Figure 3). Sixty (75%) CoNS isolated from hands and 40 (64.5%) from mobile phones were Cefoxitin resistant (Figure 4). Out of the 62 Gram-negative organisms isolated from the hands of the subjects, 52 (84%) were multiple-drug resistant, 5 (8%) were resistant to one antibiotic whereas 5 (8%) were sensitive to all antibiotics (Figure 5). The antibiotic sensitivity pattern is depicted in Figure 6.

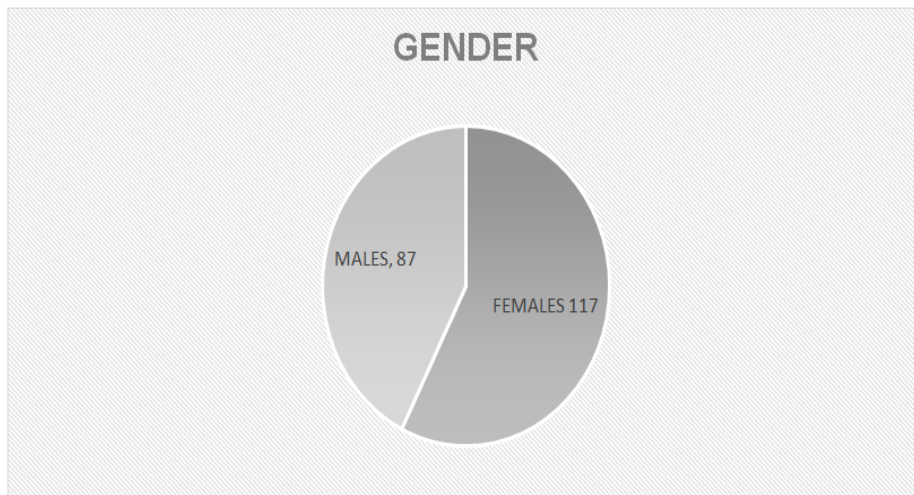


Figure 1: Gender of Subjects Included in the Study

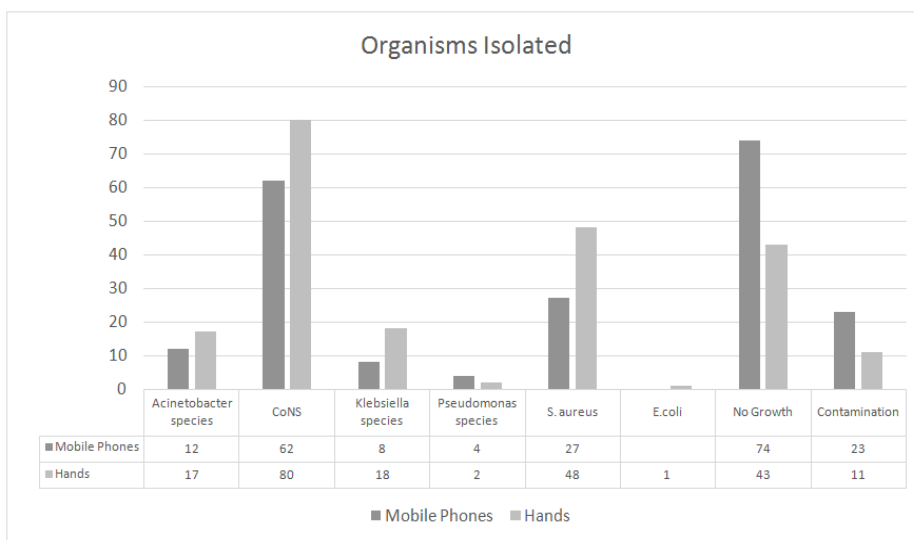


Figure 2: Organisms Isolated

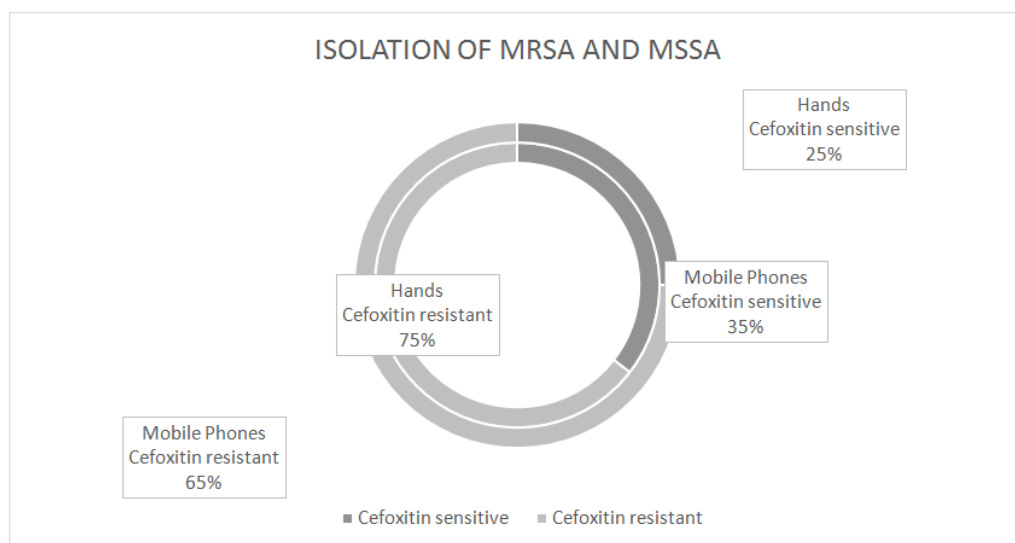


Figure 3: Isolation of MRSA and MSSA

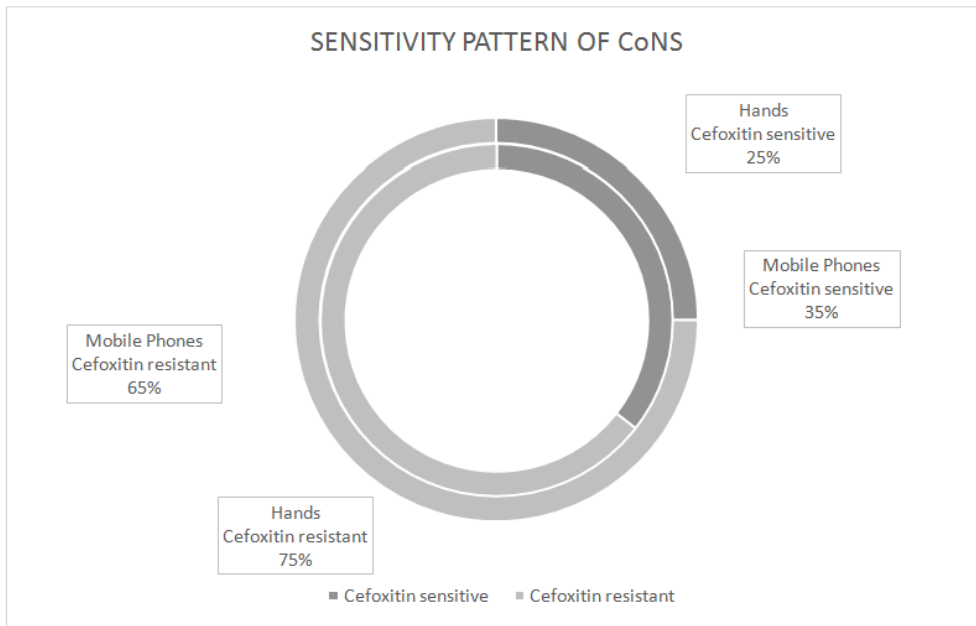


Figure 4: Sensitivity Pattern of Cons

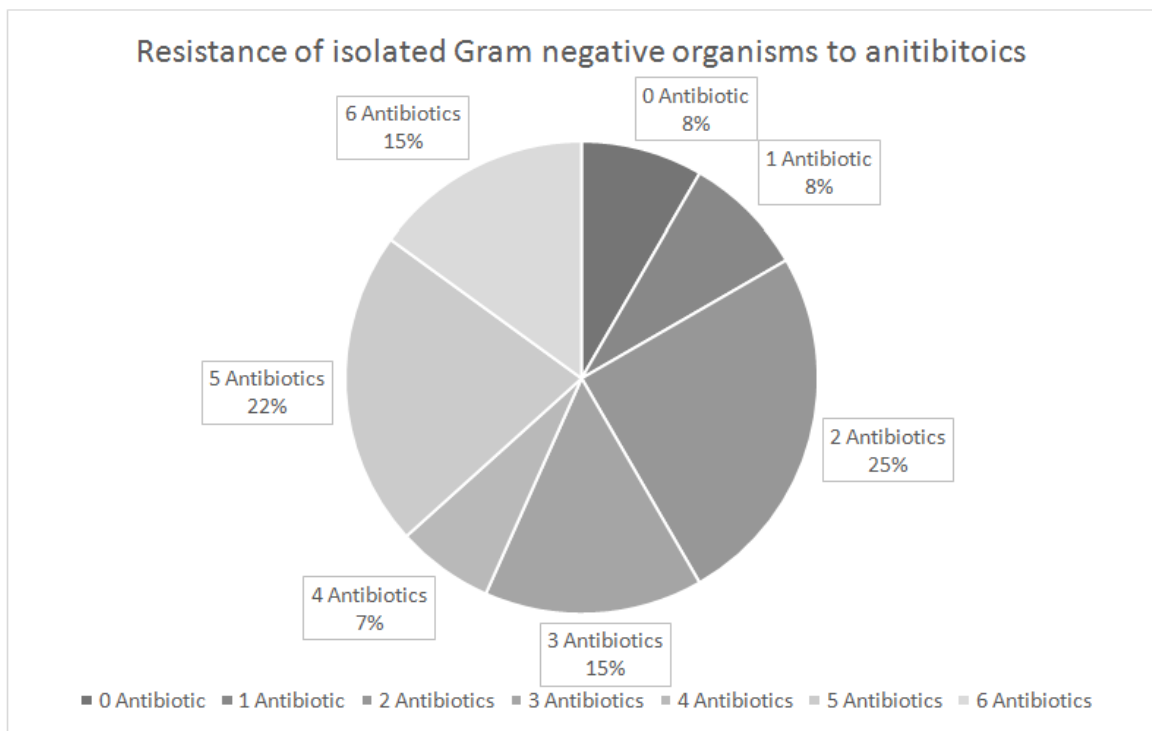


Figure 5: Resistance of Isolated Organisms to Number of Antibiotics

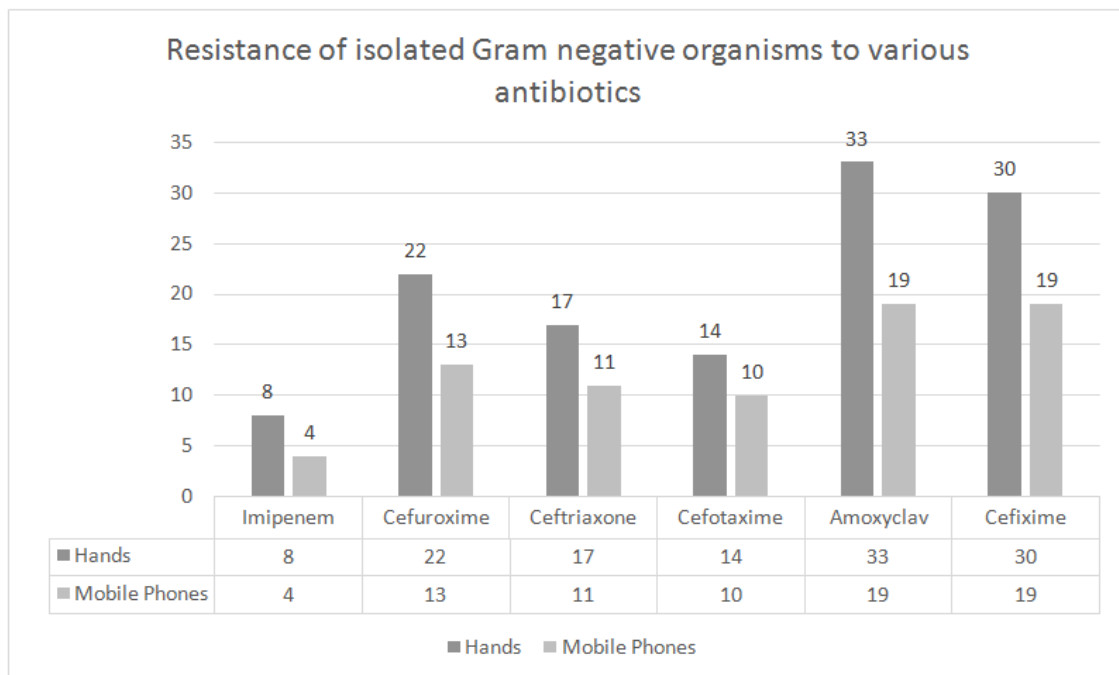


Figure 6: Resistance of Isolated Gram-Negative Organisms to Various Antibiotics

DISCUSSIONS

The spread of nosocomial infections has become a cause of serious concern in recent times due to the spread of multi-drug resistance organisms and the burden thereby caused on the economy. Previous studies, by other researchers, have suspected that mobile phones may serve as carriers for the dissemination of these infections.

In our study, the same microorganisms were isolated from the hands and mobile phones of 51 (25%) subjects, which was lower than findings by Beckstrom *et al* (90%).¹⁵ This indicates that the transmission of bacteria from the hands to mobile phones and vice versa is quite common. Many of the isolated bacteria were pathogenic and can cause diseases in not only the healthcare workers and patients, but can also lead to dissemination of infection among their family members who might also be using the phones.

In 22 (11%) subjects, organisms were isolated from the mobile phones but there was no growth of organisms from the corresponding hands. This could be due to the cleansing of hands by the subjects before taking the samples. However, these organisms can again lead to the contamination of the hands.

In the current study, the organisms were isolated from 78.9% of hands and 64% of the mobile phones which was lower than findings reported by Jeske *et al.* (95% for hands and 90% for mobile phones).¹⁶

In the present study, pathogenic bacteria were isolated from 64% of the mobile phones, which was in coordination with the studies done by other workers from Turkey (61.3%), and Nigeria (62%). Whereas other workers reported lower values than us as 45%, 43.6%, 40.62% and 32% respectively.^{17, 18, 19, 20}

However, higher rates of contamination were reported by other workers as 89.7%, 94.5% and 96.5% in their respective studies.^{21, 22, 23.}

No growth was obtained in 74 (36%) mobile phones. This value was higher than the findings reported by other

workers as 5.5%, 3.5%, 10.3% and 10% respectively.^{21,22, 23, 16} This may be due to the regular cleansing of mobile phones by the healthcare workers included in our study.

In our study, *S. aureus* and CoNS were the most frequently isolated organisms from both hands and mobile phones, which was in correlation to findings by various other studies.^{16, 22, 24}

In this study we found that 72.9% of the *S. aureus* strains isolated from hands were methicillin resistant, while from mobile phones, the value was even higher at 77.8%, whereas other workers reported lower findings as 52.0% and 31% for hands and 37.7% and 48% for mobile phones respectively.^{22, 23} However, Tamedkar *et al* (83%) reported higher values.²⁵ The higher rates of resistance might be due to the improper and frequent use of antibiotics.

In our study, we isolated 2 (1.7%) *Pseudomonas aeruginosa*, from hands and 4 (3.5%) from mobile phones, which is similar to findings reported by other workers as 3.6%, 2.7% and 2.5% in their respective studies.^{26, 27, 28} *Pseudomonas aeruginosa* is a clinically significant and opportunistic pathogen which often causes nosocomial infections. The isolation of such bacteria is of great concern as these bacteria are very difficult to manage and treat during an infection.²⁹

In the present study, 18 (15.5%) *Klebsiella* species were isolated from hands, which was higher than the findings by other workers as 0.8%.³⁰ Eight (7%) *Klebsiella* species were obtained from mobile phones, which was at par to the results found by Tagoe *et al*, (10%) and higher than the findings by Pal *et al* (3%) respectively.^{31, 30} Although *Klebsiella* species are often found as normal flora in the human nose and mouth, they can also behave as opportunistic pathogens. Organisms of *Klebsiella* are known to cause a wide variety of diseases such as pneumonia, urinary tract infections, meningitis and diarrhea among others.³²

We obtained 17 (15%) *Acinetobacter* species from hands, which was higher than the findings by Pal *et al* (8%),³⁰ while from mobile phones, 12 (11%) *Acinetobacter* species were obtained, which was higher than that reported by other workers as 6% and 3% respectively.^{33, 34} The *Acinetobacter* species have been related with plethora of nosocomial infections such as urinary tract infections and wound and burn infections.³⁵

We also isolated *Escherichia coli* (*E.coli*) from the hands of one subject. Most *E. coli* strains do not cause disease, but virulent strains can cause gastroenteritis and urinary tract infections.³⁶

Eighty-four % of the bacteria isolated during this study were multi-drug resistance, which was higher than that reported by other workers as 36% and 66% respectively.^{19, 20} This higher finding may be due to the repeated and improper use of over-the-counter antibiotics. It can be inferred that it will be difficult to treat the persons infected with these organisms.

Very few healthcare workers regularly cleanse their phone with disinfectant and as these mobile phones are used in close proximity to the body, and also to the patients, they may lead to the spread of nosocomial infections, posing a serious risk to immune compromised patients.

Some workers have stated that mobile phones may have a beneficial effect on communication and therefore improve the quality of patient care in the healthcare setup³⁷ but we found a high number of multi-drug resistant organisms on the mobile phones, which may be responsible for the spread of nosocomial infections. This is because the findings by other researchers only considered the technical aspect and did not take into account the aspect of hygiene.

CONCLUSIONS

The isolation of multi-drug resistant organisms from both the hands and mobile phones is a cause of serious concern as the treatment of a disease caused by such organisms will be recalcitrant.

As healthcare workers are more prone to exposure to bacteria, precautions such as hand washing and good hygienic practice is advocated before entering and after leaving the hospital.

It is evident from the study that there is a transfer of organisms between the hands and mobile phones. Mobile phones have become common place in daily lives and also often help in improving the quality of healthcare provided to the patients and setting up regulations on their use will be impractical.

Although mobile phones provide a technical advantage, they may also have a detrimental effect on hygiene. Therefore, it is strongly suggested that the use of mobile phones in the healthcare setup, especially in the sensitive areas such as wards should be reconsidered and mobile phone manufacturers should provide a procedure to sanitize phones to hospital standards.

Healthcare workers are also advised to regularly wash their hands after using mobile phones to prevent the possibility of mobile phones serving as vehicles of transmission of diseases.

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