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Prevalence of Nosocomial Infection Through Mobile Phones In Tertiary Care Hospitals of Punjab

MANU[1], GOMTY MAHAJAN[2], HARPREET SINGH[1]*,

[1]Department of Medical Laboratory Sciences,
Lovely School of Physiotherapy and Paramedical Sciences,
Lovely Professional University, Punjab, India
Corresponding author: Email: harpreet1.singh@lpu.co.in; Phone: +91-9417135620

[2]Department of Microbiology,
Punjab Institute of Medical Sciences,
Jalandhar, Punjab, India

ABSTRACT

Mobile phones have an integral role in everyone's life and are considered as most significant mean of communication. As everything has pros and cons, so mobile phones are not an exception. Mobile phones are the major reason to pose nosocomial infections, which are the infection acquired in hospital by the patients who are admitted for a reason other than that disease. These gadgets nourish a vast variety of microorganisms, which include *E.coli, Klebsiella species, Pseudomonas aeruginosa, Staphylococcus aureus* and many more.

In the duration of 4 months study, a total 34 pathogenic bacteria were isolated, which were further speciated by conventional methods like culture on macconkey agar, blood agar, Gram staining, biochemical testing and cefoxitin disk diffusion test.

Out of total 100 specimens taken from mobile phones, 57 were positive for bacterial isolates, indicating the prevalence rate of 57% for mobile contamination. Out of these 57 samples, 34 were pathogenic (59.6%) while 23 were non- pathogenic bacteria (40.4%). Prevalence of different organisms from total pathogenic isolates were contributed as 44.1% *E.coli,* 32.3% *Klebsiella species,* 11.8% *Pseudomonas aeruginosa,* and 11.8% *Staphylococcus aureus.* Higher number of pathogenic bacteria was found from female mobile phones (61.8%) as compared to males (38.2%).

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INTRODUCTION

In this technical oriented era, Mobile phones have become part and parcel of everyone's life, in professional as well as social life.[1]They act as an important means of communication all over the world being accessible, handy, economical and user- friendly too. Moreover, these gadgets like mobile phones are now considered as

"technological petri-dishes".[2, 3] The healthcare workers and non-healthcare workers can easily deploy it equally in each and every location. Undoubtedly, it has many merits and with such achievements, it is easy to leave unnoticed the health issues it might cause to its daily users.[4]

The frequent usage of cell phones by people in hospital like patients, patient relatives and HCWs etc., are gaining popularity in case of transmission of bacteria as well as hospital acquired infection, because such microorganisms are present in palms,[5] and the heat, which is generated by, mobiles ultimately help to grow bacteria on the gizmos.[6] Hospital acquired infection are one of the heinous obstacle in hospitals,[7] consequently will lead to escalation in the mortality as well as in morbidity rate, and will also raise health care cost.[8] As Intensive Care Units [ICUs] are such workplaces, which highly needed hygienic standards, this is also required for personnel working and the instruments used by the workers, so PICU and NICU are not exceptions.[9] Mobile phones are non-medical devices, which are used expensively[10] but not cleaned properly because HCWs do not clean their hands before handling it [11-14] so HCWs acts as carrier, may work as vectors[15] and subsequently carry commensal and pathogenic bacteria and pose nosocomial infection risk.[16, 17]

In the recent years, to check the crucial role-played by mobile phones of people in the transmission of nosocomial pathogens[18] such as *Staphylococcus auerus, E.coli, Klebsiella species, Pseudomonas* etc. *Staphylococcus aureus* is stably the root cause of HAI.[19, 20] *Methicillin Resistant Staphylococcus* auerus (MRSA) has increased as a consequent of ill rational use of drugs.[21, 22] Despite of increase incidence of nosocomial infection with mobile phones as the pivotal source many health professionals are still unaware.

MATERIALS AND METHODS

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COLLECTION OF SAMPLE

For this study an informed consent was taken and samples were collected by rubbing the sterile swab over the screen, buttons of the keypad, earpiece, front, back, lateral side of the mobile phone.[23]

PROCESSING OF SAMPLE

A prospective study was conducted from January 2019 to April 2019 in the department of Microbiology at a Pediatric hospital. Swabs were collected from the surface of mobile phones of doctors, nurses, technicians, helpers and other health care workers. These swabs were enriched with Thyoglycollate broth overnight and next day inoculation was done on enriched (blood agar) and differential media (MacConkey agar)[24]. Growth was detected after 24 hours of aerobic incubation at 37degree celsius. Colony characters were noted, biochemical tests were applied & grams staining performed for final identification

IDENTIFICATION OF ISOLATED BACTERIA

The culture plates were observed after 24-48 hours of incubation and identified by colony characteristics which were further confirmed by different methods like gram staining, biochemical testing, cefoxitin disc susceptibility on MH agar for *MRSA* detection in case of *Staphylococcus aureus.*

Gram staining: It is very ubiquitous and efficient technique used to differentiate the bacteria based on their cell wall constituents. Moreover, the Gram stain components aid to distinguish between Gram positive as well as Gram-negative bacteria by coloring their cells red or violet.[25]

BIOCHEMICAL TESTING

Biochemical tests are those tests, which are basically deployed for the identification and differentiation of microorganism based on the differences in the biochemical activities of various bacteria.[26] These differences can be seen in different factors like carbohydrate, protein, and fat metabolism, and such factors aid them to be identified by the biochemical tests.[27, 28]

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CEFOXITIN DISC DIFFUSION METHOD FOR MRSA DETECTION:

An antibiotic susceptibility test is performed to select the antibiotic that will be most effective as well as suitable against particular organism. *MRSA* has become serious problem, as resistance to these antibiotics results in resistance to all beta lactam antibiotics.[29] As *Staphylococci* are the root causative agents of hospital acquired actions. There is phenotypic method such as MIC determination by disc diffusion testing for the identification of of *MR Staphylococci* and its utterance of defiance can change subject to its different growth conditions like temperature, osmolarity, and culture medium ingredients.[30] The mecA gene is the eminently hoard in *Staphylococcus* strains and is appropriate marker of oxacillin defiance. Low sensitivity and low specificity of susceptibility to oxacillin dissimilarity with cefoxitin for the identification of MR isolates. Cefoxitin DD test is less sensitive but more precise than oxacillin DD tests and for the precise screening of *MRSA* both disc should be included in DD test.[29, 31]

RESULTS

The study was conducted at Ankur Hospital (Synergy lab), Jalandhar from 1st January to 29th April 2019. Total 100 mobile samples were examined in this study out of which 57 were positive. Among those 57 samples, 23 were non-pathogenic whereas 34 were pathogenic isolates from the healthcare staff. So the overall percentage of positive pathogenic isolates are 59.6 percent.

Table 1: Prevalence of positive isolates from total samples.

Total sample	Positive isolates	Percentage
100	57	57%

Table 2: Prevalence of Pathogenic and Non- pathogenic organisms.

	Frequency	Percentage
Total positive isolates	57	100%
Pathogenic	34	59.6%
Non- Pathogenic	23	40.4%

Among those 57 positive isolates, pathogenic organism 59.6% was found to be higher followed by Non- pathogenic organisms 40.4% (Fig. No 1).

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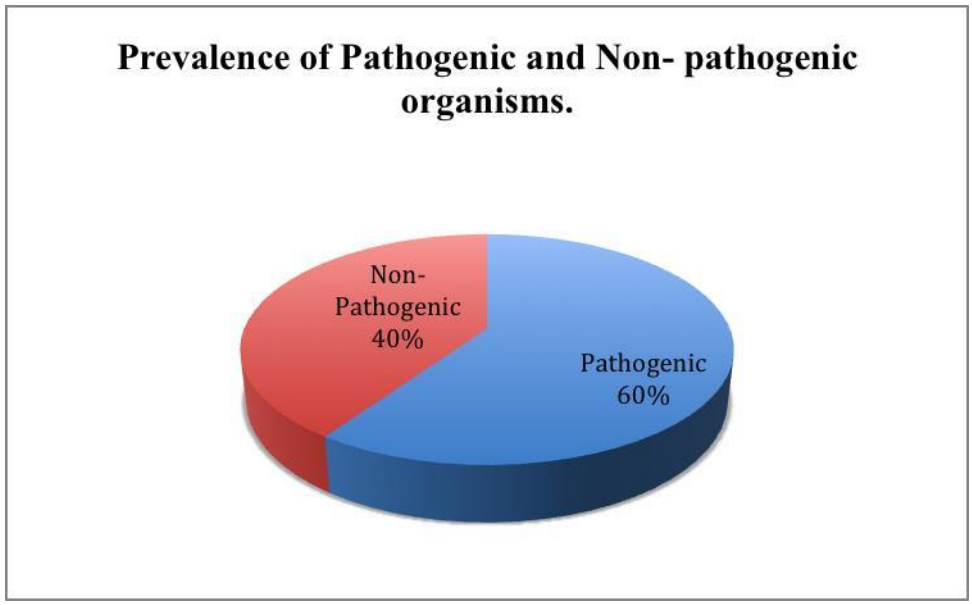

Fig. No 1: Prevalence of Pathogenic and Non- pathogenic organisms.

Table 3: Prevalence of different bacteria from total pathogenic isolates.

	Frequency	Percentage
Total pathogenic	34	100%
E.coli	15	44.1%
Klebsiella species	11	32.3%
Psuedomonas aeruginosa	4	11.8%
Staphylococcus aureus	4	11.8%

Among those 34 pathogenic isolates, *E. coli* were 15, *Klebsiella* species were 11 but *Pseudomonas aeruginosa* as well as *Staphylococcus aureus* were 4. So the prevalence of *E. coli* is 44.1%, *Klebsiella* species are 32.3% while *Pseudomonas aeruginosa* and *Staphylococcus aureus* are 11.8% (Fig. No. 2)

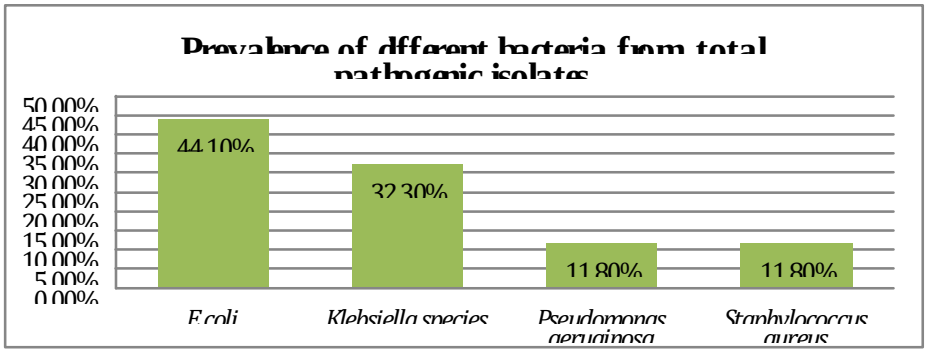

Fig. No. 2: Prevalence of different bacteria from total pathogenic isolates.

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Table 4: Prevalence of Gram positive and Gram-negative organisms.

Organism	Frequency	Percentage
Gram positive	4	11.8%
Gram negative	30	88.2%

Among those 34 pathogenic isolates, Gram-negative organism showed higher rate 88.2% as compared to Gram-positive organism 11.8% (Fig. No 3)

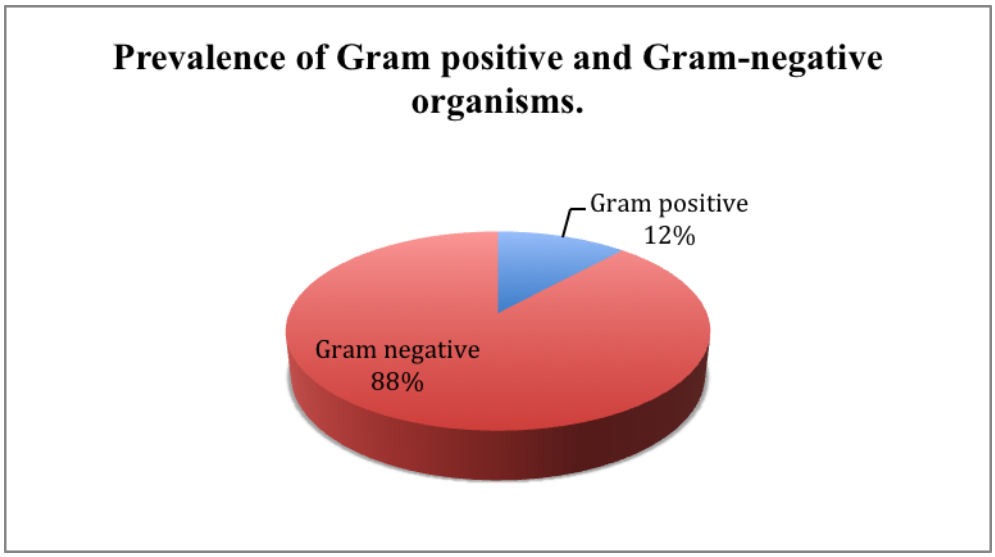

Fig. No 3: Prevalence of Gram positive and Gram negative organisms.

Table 5: Prevalence of isolated MRSA and MSSA.

	Frequency	Percentage
Total *S. aureus*	4	100%
MRSA	2	50%
MSSA	2	50%

From total 4 *S. aureus*, *MRSA* and *MSSA* both contributed in equal amount [50%] respectively (Fig. No 4)

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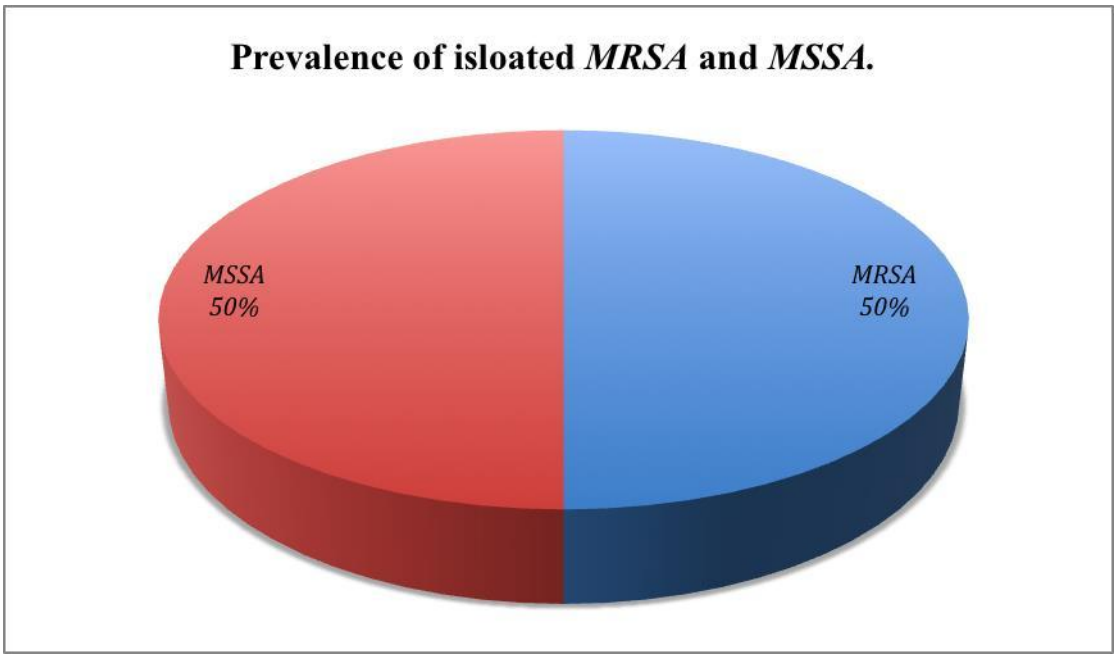

Fig. No 4: Prevalence of isolated *MRSA* and *MSSA*.

Table 6: Prevalence of pathogenic organism in different gender.

Gender	Total pathogenic	Percentage
Male	13	38.2%
Female	21	61.8%
Total	34	100%

Maximum number of Pathogenic organisms was found from Female samples 61.8% and minimum number from Male samples 38.2% (Fig. No 5)

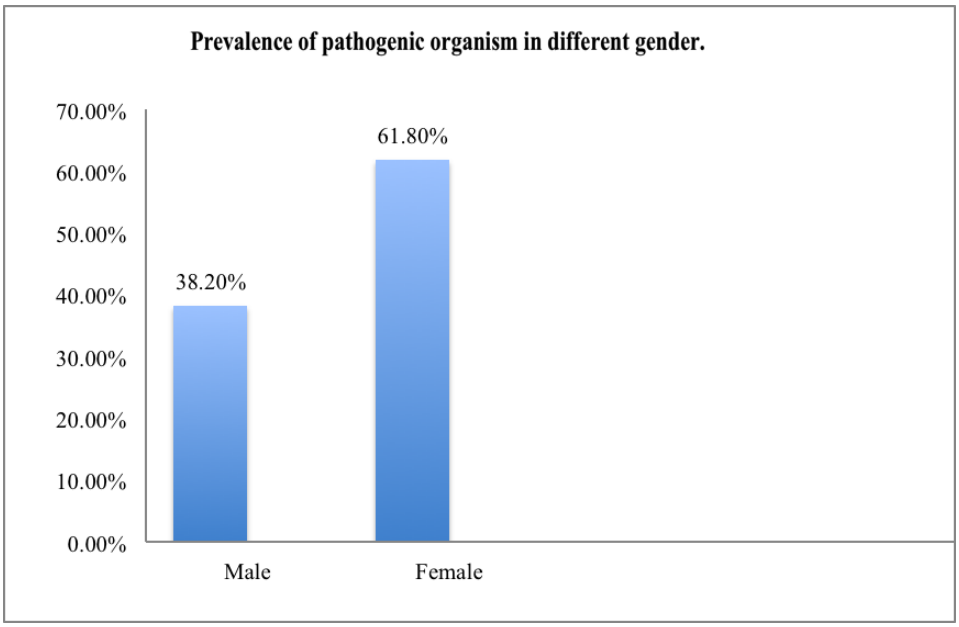

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Fig. No 5: Prevalence of pathogenic organism in different gender.

Table 7: Prevalence of isolated bacteria from different departments.

Departments	Total pathogenic	Percentage
AO office	0	0%
Reception	1	2.9%
Front office	2	5.9%
Cash counter	2	5.9%
Doctors	2	5.9%
Laboratory	6	17.6%
Helpers	3	8.8%
Security	2	5.9%
PICU	3	8.8%
NICU 1,2,3	7	20.6%
Canteen	2	5.9%
Riders	4	11.8%
Total	34	100%

Maximum number of organism was isolated fr56om NICU 1,2,3 20.6% whereas minimum number was isolated from AO office (Fig. No 6)

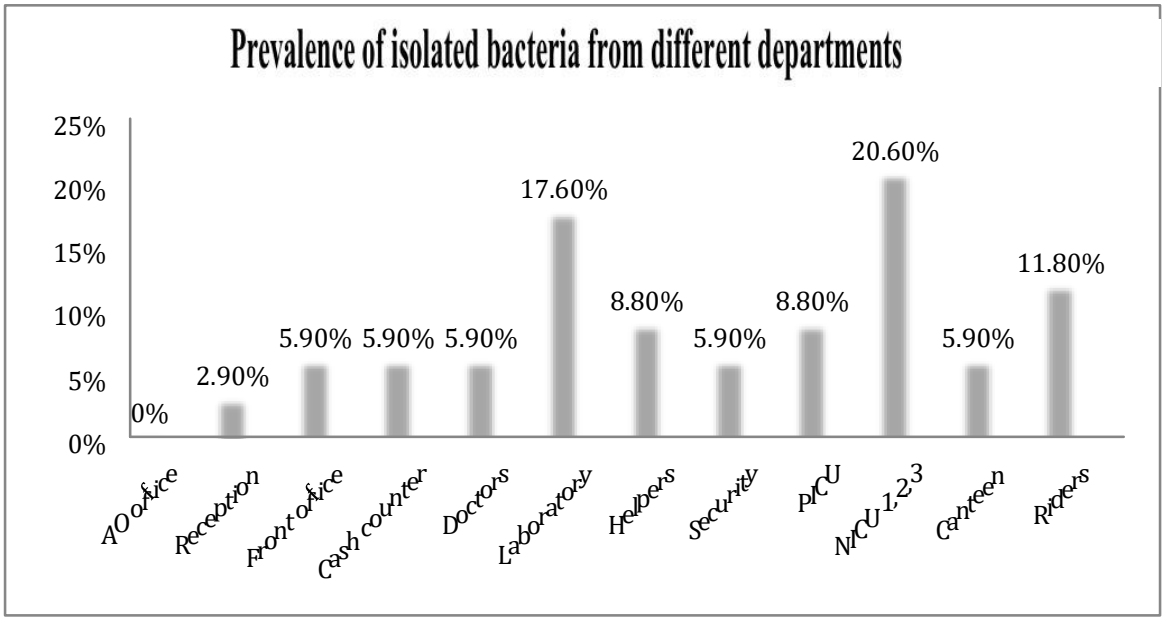

Fig. No 6: Prevalence of isolated bacteria from different departments.

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DISCUSSION

Out of 100 mobile phone samples, 57 were found contaminated with various numbers of bacteria. Out of which 34 (59.6%) were found as pathogenic bacteria and 23 (40.4%) were found as non- pathogenic.

According to studies of Togoe DN et al., Bhat SS et al., Ulger F et al., Badr et al., Kuhu Pal et al., Dutta et al., Panchal et al. where the incidence of contamination were 100%, 99%, 94.5%, 93.7%, 87%, 72% and 65% which are more than results of our study.[5, 9, 32]

But our results was more than that were observed in the studies of Arora U et al., Trivedi HR et al. where the incidence of contamination were 40.62% and 46.6% respectively.[33]

Broad range of dissimilarity might be due to difference in perception regarding usage of mobile phones, perpetuate hand hygiene and repetition of handling of mobile phones during care of the patient.

Species wise distribution

The present study reports 40.4% of E. *coli*, which is in concordance with the result of Vachhani et al., where E. *coli* was 40%. But another study directed by Kuhu Pal et al., described that E. *coli* was 1.48%, which is dissimilar with our result.[34, 35]

Moving to *Klebiella species*, *which* were found as 32.3% in our study, but according to Kuhu Pal et al., *Klebiella species* were found 1.48%, which is not related with our results.[34] Moreover 11.8% were *Pseudomonas aeruginosa*, which in concordance with the result of Anitha et al., where *Pseudomonas aeruginosa* were discovered as 10.1% and also said that it is considered as 4th most commonly isolated nosocomial pathogen whereas Dricoll et al., reviewed that the fatality rate of *Pseudomonas aeruginosa* was 50%, which is not match with our study.[36, 37]

The study conducted by Kuhu Pal et al., reported that the prevalence of *Staphylococcus aureus* was 14.07% which is concordance with our results where as another studies by Chaka TE et al., and Almugadam BS et al., the prevalence of *Staphylococcus aureus* were 59.7% and 56.14% which are outweigh than our study [7, 18, 35]

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Distribution of Gram positive and Gram-negative bacteria.

Gram-negative organism was isolated in 88.2 %. Studies by Datta P et al., Akinyemi Kabir O et al., Amira HA et al., and Roy R C et al. also had done in the same field reflect the different feature except the studies of Bhat SS et al., Ulger F et al., and Tagoe D N et al.[5, 9, 32, 38]

Distribution of MRSA and MSSA

In our study, MRSA and MSSA was isolated from 50% each, which is much higher than the previous studies Anupriya A et al., where MRSA and MSSA were 2.1% and 8.2% respectively. To add on it, study conducted by Badr et al. and Pal et al. reflected that rate of prevalence of MRSA was 31% and 21.05% respectively.[2, 20]

Gender wise distribution

Almost equal amount of growth was found in the mobile phones used by female as well as male staff. But the study by Kokate et al., the proportion of contamination in the gadgets of males were more as compared to females, which is not concordance with our results because it shows female as 61.8% and male as 38.2%. So this is dissimilar to previous study.[14]

Department wise distribution

In our study most of the species were isolated from NICU 1,2,3 department (20.6%) followed by Laboratory (17.6%), Riders (11.89%), Helpers and Pediatric ICU (8.8%) and Doctors (5.9%) etc. Results from our study showed 17.6% of mobile phones of Laboratory, which showed an upward trend than the mobile phones of doctors (5.9%). Hence, the same trend was followed by earlier studies of Tambe N.N et al., Kuhu Pal et al., Trivedi HR et al., Akinyemi K O et al. On the other hand, according to the study of Vachhani et al., pediatric ward constitutes 4-17% chances of infection, and in our results PICU ward showed 8.8% chances of infection, which comes under the above range.[3, 33-35, 38]

Direct contact to different samples like tissues, body fluids etc. consisting of non-identical pathogens might be the motives of greater carriage rate in clinical laboratory and NICU.

CONCLUSION

From this study, it can be concluded that majority of mobile phones belonging to HCWs harboured pathogenic isolates including few MDR strains like *MRSA* but HCWs were quiet unaware of the fact. They were the major cause of nosocomial infection because the heat

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generated from those mobile phones ultimately nourishes a lot of bacteria and transfer to HCWs dominant hands. The surface spread technique is quiet convenient yet useful gadget for detection and listing of bacteria's infecting mobile phones. Moreover, hand washing before and after handling a call is to be recommended strictly while mobile dis-infection method are extremely important for hospital personnel as well as patients and visitors, as it has a great influence in infection control.

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