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Original Research Article

Role of Fomites in the Health Care Associated Infections in Tertiary Care Hospitals

Sandhya Rani T.[1], Saileela K.[2]

[1]Department of Microbiology, Katuri Medical College, Guntur,

[2]Department of Microbiology Kamineni institute of Medical sciences, Narketpally, Nalgonda

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Corresponding Author: Dr. Sandhya Rani T.

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Abstract:

Objectives: Microorganisms can be transmitted from animated resources to inanimate environmental assets. They can also emerge as secondary reservoirs if they meet transmitted pathogens as they needs to live and multiply. In the present study aim Role of fomites in the health care associated infections in tertiary care hospitals.

Methods: A retrospective cross-sectional study was performed among 100 sample were randomly collected between June – July, 2022from, Katuri Medical College Guntur. We were taken the sample from the Mobile, stethoscope, pen, watch, apron and key chain of health care workers such as Doctors, Pg students, intern and nurses at high-risk area like ICCU, MICU, SCIU and NICU. These fomites are the most frequently used and contaminated easily with fingers. Rolling over the exposed surfaces of each fomite and using sterile swabs soaked with sterile 0.9% NaCl allowed samples to be collected aseptically.

Results: Majority of bacteria isolated from HCW's mobile phones were Methicillin resistant *Staphylococcus aureus (*30.7%).23% of the pseudomonas aeruginosa isolated from HCW's mobile phones.2.5% clostridium spp were identified on mobiles phone of HCW's.

Conclusions: Necessitate for educating the patients and their attendees about the risk of hospital acquired infections and self-measures required to be taken by them. Monitor the screening of the hospital and its environment for the pathogenic bacteria presence.

Keywords: Fomites, HAI (Healthcare associated infections),MRSA(Methicillin-Resistant Staphylococcus aureus),VRE(Vancomycin-resistant Enterococcus sp).

Introduction

Usually, microorganisms can be transmitted from animated resources to inanimate environmental assets. They can also emerge as secondary reservoirs if they meet transmitted pathogens as they needs to live and multiply. In healthcare settings, infected surfaces might not always be preferred for microbial survival and multiplication nevertheless may also play a function within the chain of contamination, because surfaces close to the affected person's surroundings may be touched at high frequencies, allowing transmission from lively assets to others via contaminated inanimate surfaces.

Due to this, they know-how at the survival of microorganisms, fungi, viruses, and protozoa on surfaces, and subsequently, in a broader sense, inside the Healthcare associated Infections (HAI). In addition, such know-how may even assist making sure bio protection in microbiological and biomedical laboratories, meals-handling settings, and for hygienic behavior in normal lifestyles to prevent transmission of infectious diseases. Healthcare settings, a microorganism such as bacterial spores, viruses and yeasts are mainly transmitted from inflamed and colonized patients, additionally from group of workers, and in some conditions from visitors to the inanimate clinic environment, particularly to areas adjoining to patients and regularly touched surfaces by arms. Potential infections that are released by infected patients and healthcare staff that frequently contaminate the surrounding clinical environment include methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant Enterococcus sp. (VRE), Clostridium difficile spores and norovirus. These viruses have a months-long shelf life on surfaces, making direct or indirect patient contact a possibility [1].

The most common types of health center-received contamination are due to invasive strategies completed on patients including surgical operations, intravenous remedy, intubation, and catheterization. Immuno-competence of varying stages is seen among the sufferers admitted to the medical institution. These include sufferers at the extremes of age, people with diabetes, receiving immunosuppressive capsules, and people with most cancers, especially those present with process chemotherapy. These sufferers are at risk of infection with bacteria that have little chance for healthful men and women.

Even though, microbiologically infected air, water, and fomites can serve as vehicles of transmission, their contribution to contamination and disease is hard. Inanimate items which end up contaminated by way of microorganisms and the function direction of transmissions of such organisms are called fomites [2]. It contributes significantly to the spread of several illnesses, however, the volume to which formitic reservoirs put into the overall rate of nosocomial or environmental infections is unknown.

Environmental surfaces, objects, and medical devices, together with blood pressure cuffs, stethoscopes, digital thermometers, infusion pumps, and hemodialysis machines, can serve as capacity reservoirs for nosocomial pathogens that can be transmitted by using the hands of HCWs to patients inside the absence of adequate hand hygiene [3]. Cross-transmission via the fingers of HCWs, who either grow to be contaminated at once from affected person contact or indirectly utilizing touching contaminated environmental surfaces, has been implicated in 20 to 40% of HAIs[4].

Less typically, a patient may end up colonized by using direct contact with an infected environmental surface [5]. Even if floors are closely infected with C. difficile and MDROs, inclusive of VRE and MRSA, and are available in contact with high-touch gadgets, they may be underappreciated sources of transmission of nosocomial pathogens .[4]

Doctors' stethoscopes continue to be a possible supply of contamination for diverse pathogens, and proof shows that microorganisms can transfer from the pores and skin to the stethoscope and vice versa[5] the majority of organisms are non-pathogenic, potential pathogens, such as MRSA, Pseudomonas, VRE, and C. difficile, have also been isolated. However, a hyperlink between infected stethoscopes and HAIs has now not been hooked up[6].Mobile verbal exchange gadgets can also serve as reservoirs for nosocomial pathogens; however, their position in the transmission is that medical charts, especially in clinical, surgical, and pediatric ICUs, are extraordinarily contaminated with microorganisms and potential sources of contamination[7].

In healthcare centers, microbially contaminated surfaces also play a role in the indirect transmission of infection. Therefore, we must study the microorganisms that can survive on the surfaces of objects. The present study is to aim an evaluation of the burden of bacterial flora over the surface of fomites in causing healthcare-associated infections in tertiary care hospitals.

Material and methods

A retrospective cross-sectional study was performed among 100 sample were randomly collected between June – July, 2022 from Katuri Medical College Guntur. We were taken the sample from the Mobile, stethoscope, pen, watch, apron and key chain of health care workers such as Doctors, Pg students, intern and nurses at high risk area like ICCU, MICU, SCIU and NICU. These fomites are the most frequently used and contaminated easily with fingers. Samples were taken aseptically by rolling over the exposed surfaces of each fomites and using sterile swabs saturated with sterile 0.9% NaCl.

The samples were collected, moved right away to the lab, and inoculated on 5% sheep blood agar and Mac-Conkey's agar. The plates were then aerobically incubated for 24 hours at 37°C. Following incubation, plates were checked for the isolates' growth and colonial appearance. Following accepted microbiological methods, both Gram-positive and Gram-negative bacteria were detected.

As per the CLSI recommendations for antibiotic disc susceptibility testing, Mueller-Hinton agar was used to assess antibiotic sensitivity using the Kirby-Bauer disc diffusion method[8]. A 10µg dose of ampicillin was evaluated as an antibacterial agent for Gram-positive cocci. erythromycin (15µg), clindamycin (2µg), ciprofloxacin (5µg), cotrimoxazole (1.25/23.75µg), cefoxitin (30µg), and tetracycline (30µg) are the medications that were used. Pipericillin-tazobactam (100/10 µg), ceftriaxone (30 µg), cefepime (30 µg), imipenem (10 µg), co-trimoxazole (1.25/23.75 µg), amikacin (30 µg), ciprofloxacin (5 µg), and meropenem were the antimicrobial drugs that were tested for Gram-negative bacilli.

Inclusion criteria: Samples are collected only from the regularly used objects by health care personals and surroundings.

Exclusion criteria:

- Samples will not be collected from the objects that are been sanitized before two hours of sampling.
- Sample will not be collected from the objects of subjects who are suffering from a known bacterial infection.

Data analysis: Obtained data will be tabulated. Descriptive data will be presented as frequencies. Appropriate statistically significant tests will be conducted to find out the association. P Value <0.05 will be considered significant.

Results

During the survey period, a total of 100 samples were collected from ICCU, MICU, SICU and

NICU wards through the survey period, i.e., from June to July-2022. In this study, a total of 100 samples were examined, out of which ninety eight samples were showed significant growth and 2 samples were no growth.

Table 1: Distribution of samples in different wards

Wards	Number of samples
ICCU	22
MICU	16
SICU	42
NICU	20
Total	100

- The majority of samples collected from SICU followed by ICCU

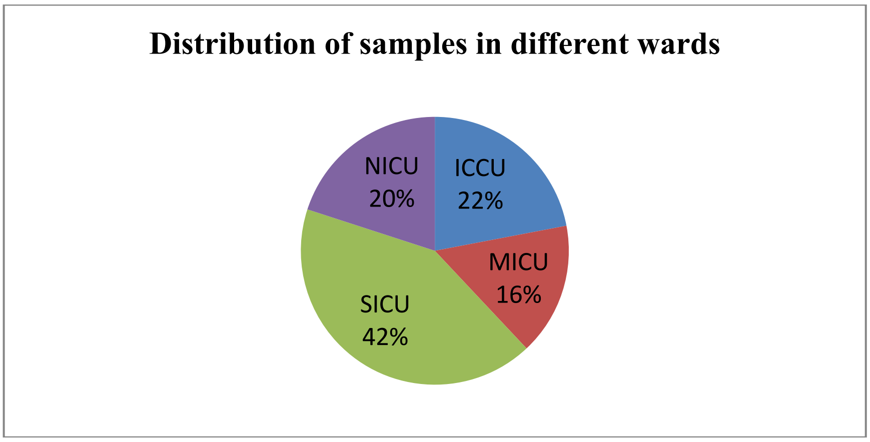

Figure 1: Distribution of samples in different wards

Tables 2: ward wise distribution of formites

Fomites	ICCU	MICU	SICU	NICU	%
Mobiles	9	5	18	7	39%
Stethoscope	3	3	3	4	13%
Pen	3	1	1	1	6%
Watch	-	1	1	3	5%
Apron	8	5	16	5	34%
Keychain	-	-	2	1	3%
Total	22	16	42	20	100

- Majority of samples were collected from the mobiles
- Less samples were collected from key chains

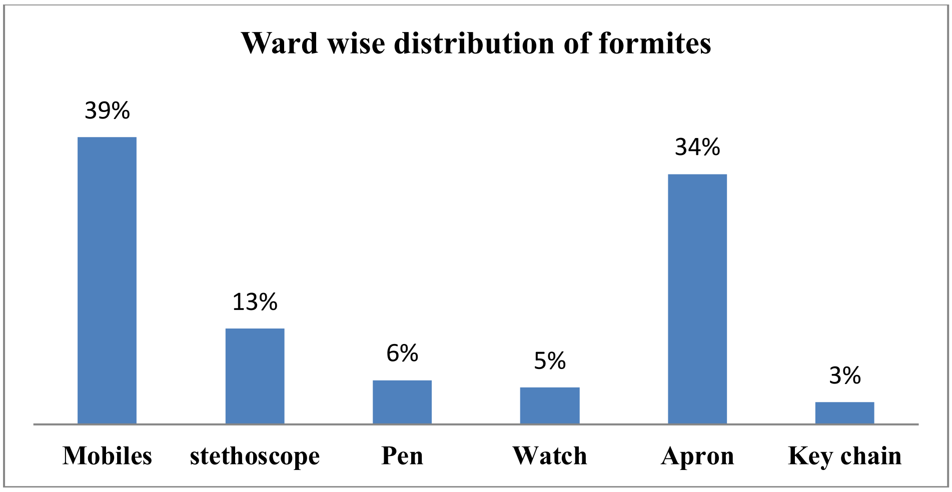

Figure 2: Ward wise distribution of formites

Table 3: Number and type of bacteria isolated from HCW's mobile phones

Name of the organism	Number of isolated (39)	Percentage
Methicillin susceptible Staphylococcus aureus	2	5.1%
Methicillin resistant Staphylococcus aureus	12	30.7%
Methicillin susceptible coagulase negative Staphylococci	5	12.8%
Methicillin resistance coagulase negative Staphylococci	4	10.2%
Pseudomonas aeruginosa	9	23.0%
Acinetobacter spp	3	7.6%
Citrobacter spp.	2	5.1%
Escherichia. coli	1	2.5%
Clostridium spp	1	2.5%

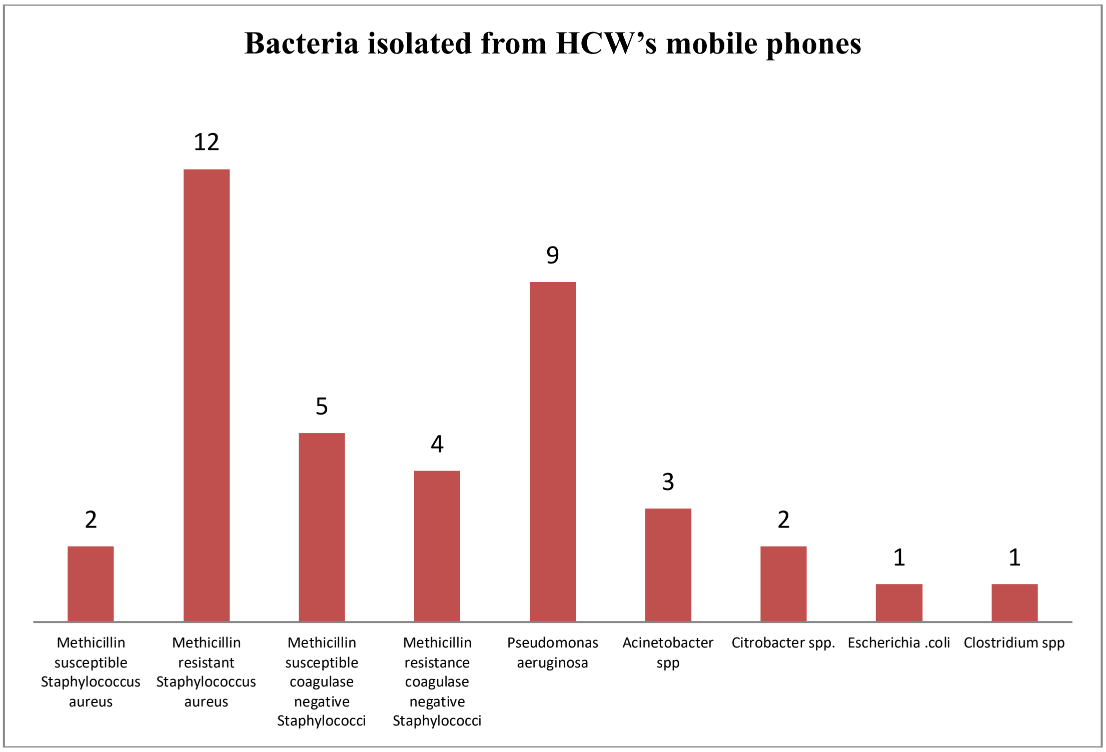

Figure 3: Bacteria isolated from HCW's mobile phones

- Majority of bacteria isolated from HCW's mobile phones were Methicillin resistant Staphylococcus aureus (30.7%)
- 23% of the pseudomonas aeruginosa isolated from HCW's mobile phones.
- 2.5% clostridium spp were identified on mobiles phone of HCW's

Table 4: Number and type of bacteria isolated from HCW's Aprons

Name of the organism	Number of isolated(34)	Percentage
Methicillin sensitive Staphylococcus aureus	16	47.0%
Methicillin resistant Staphylococcus aureus	9	26.4%
Klebsiellapneumoniae	6	17.6%
Pseudomonas aeruginosa	3	8.8%

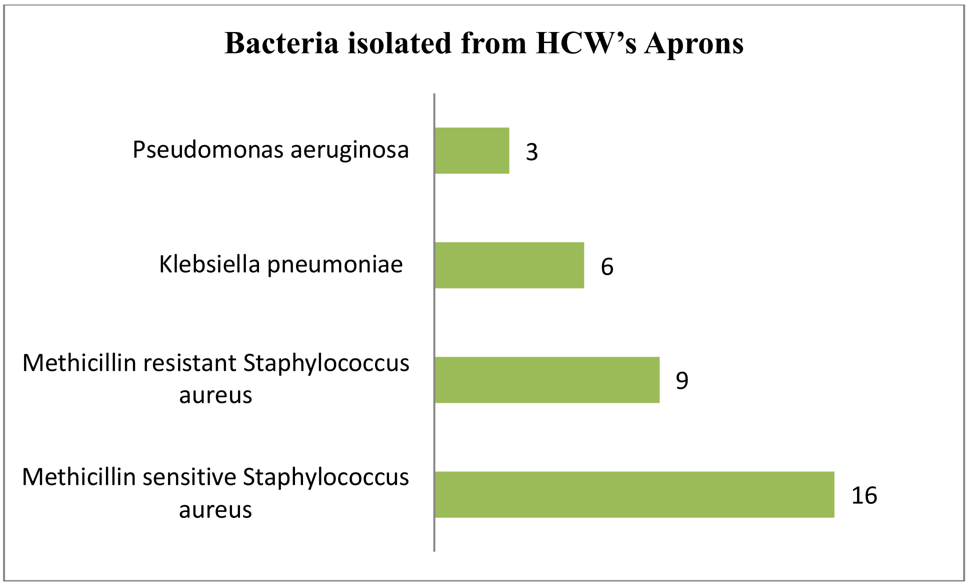

Figure 4: Bacteria isolated from HCW's Aprons

- Preponderance of bacteria isolated from HCW's Apron were Methicillin sensitive Staphylococcus aureus 47.0%
- Gram positive cocci 9(Methicillin resistant Staphylococcus aureus) isolated on aprons of HCW's.

Table: 5 Number and type of bacteria isolated from HCW's Stethoscope

Name of the organism	Number of isolated(13)	Percentage
Acinetobacter spp	6	46.1%
Enterococci spp	4	30.7%
Pseudomonas aeruginosa	3	23%

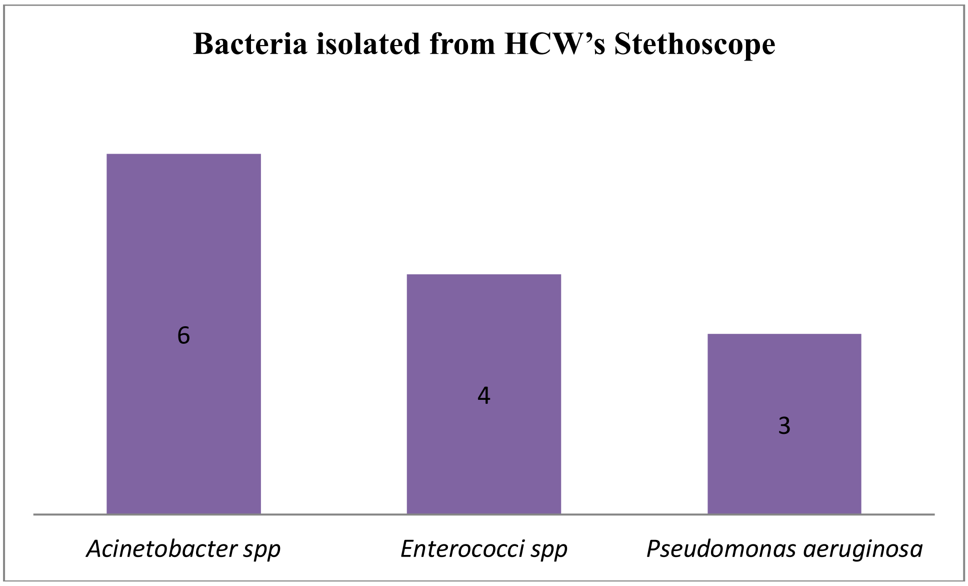

Figure 5: Bacteria isolated from HCW's Stethoscope

- Preponderance of bacteria isolated from HCW's Apron were Acinetobacter (46.1%) followed by Enterococci spp (30.7%)
- 23%of pseudomonas aeruginosa isolated from HCW's Apron

Table 6: Number and type of bacteria isolated from HCW's Pen

Name of the organism	Number of isolated(6)	Percentage
Coagulase negative Staphylococci	4	67%
Pseudomonas aeruginosa	2	33%

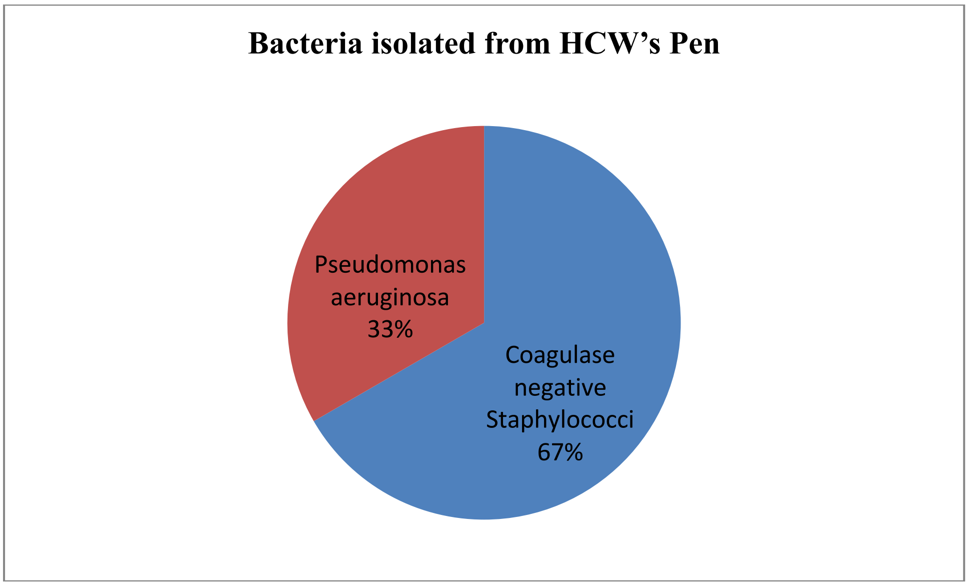

Figure 6: Bacteria isolated from HCW's Pen

- The most common bacteria cultured were Coagulase negative Staphylococci (67%)
- 33% Pseudomonas aeruginosa from HCW's Pen

Table 7: Number and type of bacteria isolated from HCW's Watch

Name of the organism	Number of isolated(5)	Percentage
Bacillus spp	2	40%
Methicillinresistance Staphylococciaureus	1	20%
Enterococci spp	1	20%
Clostridium spp	1	20%

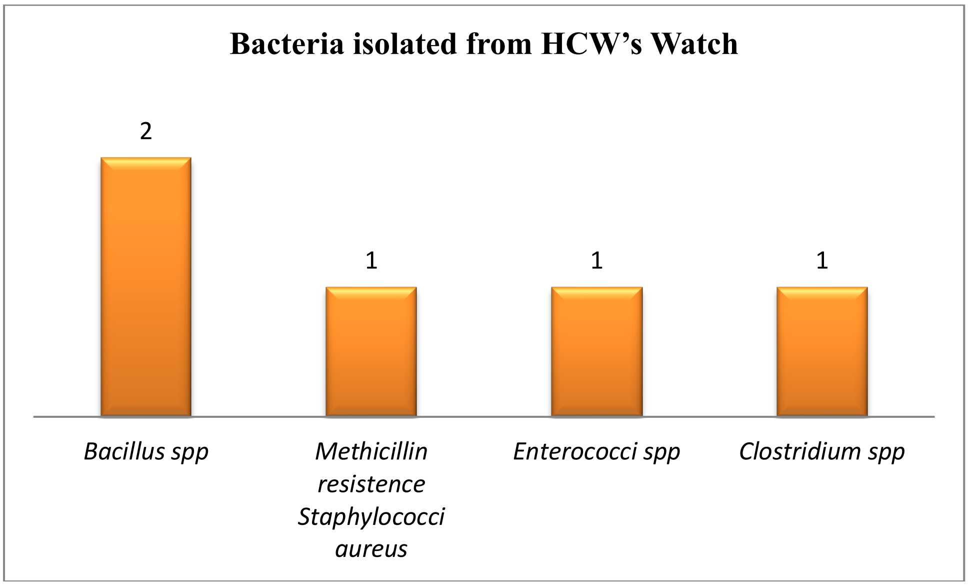

Figure 7: Bacteria isolated from HCW's Watch

- Majority of bacteria isolated from HCW's watch were Bacillus spp 40%
- 20% of the bacterial Methicillin resistance Staphylococci aureus, Enterococci spp, and Clostridium spp

Table 8: Number and type of bacteria isolated from HCW's Key chain

Name of the organism	Number of isolated(3)	Percentage
No growth	2	66%
Pseudomonas aeruginosa	1	33%

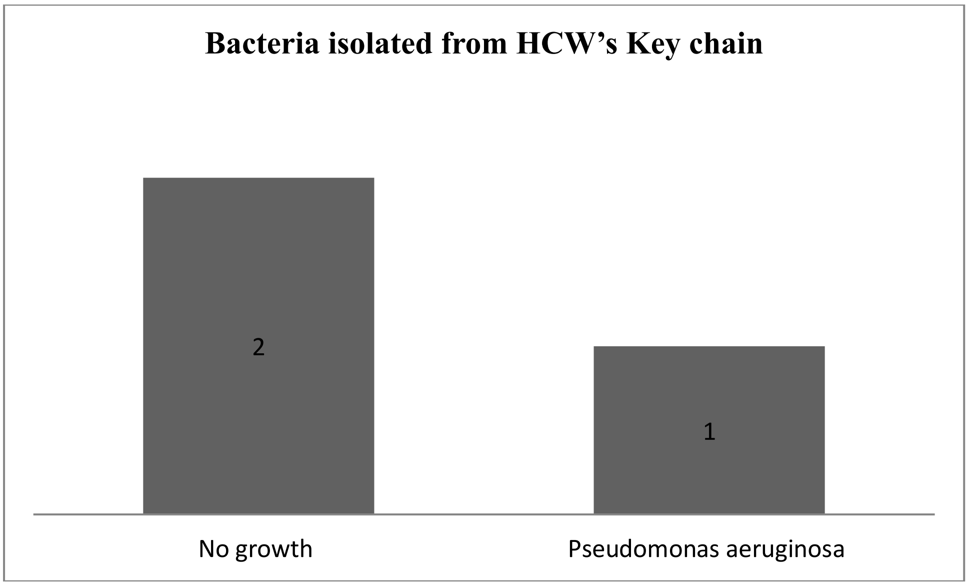

Figure 8: Bacteria isolated from HCW's Key chain

Majority of bacteria isolated from HCW's key chain were Pseudomonas aeruginosa 33%

Discussion

The hospital surroundings performs a completely crucial role in the transmission of micro-organisms inflicting HAIs. Bacterial pathogens are colonized on human host and inanimate gadget, but most of the people don't recognize that bacteria are observed on many common objects within the outdoors, of their places of work and homes. Microorganisms may be transferred from person to person or from inanimate objects. In the present study, six inanimate objects like mobiles, stethoscopes, pens, apron, watch and key chain were studied for microbial colonization.

Mobile phones are used without restriction in healthcare facilities, including specific, susceptible areas like the ICCU, MICU, SICU and NICU wards regardless of their unknown microbial load. In present study, 39.7% of the bacterial growth isolated in HCWs mobile phones. This rate of contamination of mobile phones of HCW correlated with the Neha S, et al [8] studies which may be due to the variation of the adherence to infection prevention, the pattern of mobile phone use, mobile phone keeping habits and personal behavior and directly contact with patients.

In this study, Out of 39 bacteria isolated, Methicillin resistant Staphylococcus aureus12 (30.7%) were predominant bacteria, grown from HCWs mobile phones which correlated with Lawani et al. study[9].MRSA is of fastidious significance in the medical community, as it has evolved resistance to β-lactam antibiotics. The second common bacteria isolated from HCWs mobile phones was Pseudomonas Aeruginosa.

It is a Gram-negative rod shaped which are characterized by their irregular, greenish yellow pigmented colonies. It is resistant to the chemical disinfectant and grow certain antiseptic which can be found in the normal skin flora as well as in soil and bodies of water, amongst others. Metallo- β-lactamases (MBL) strains of Ps. aeruginosa has been arisen, which combined with its ability to persist in hospital environments for extended periods of time, has led to its emergence as a potentially dangerous nosocomial pathogen. Ps. Aeruginosa(23.0%)was the predominant organism isolated from mobile phones of HCW's working in ICCUs and from nursing(12.82%) professionals in this study. Dardi et al[10], findings says that the staphylococci isolated were 100% susceptible to linezolid and 80% were susceptible to ciprofloxacin,this is similar to our study.

Present study showed P. aeruginosa was susceptible to imipenem (97.43%) and amikacin (94.87%). K. pneumoniae were susceptible to imipenem (100%), amikacin (100%) and ciprofloxacin (90%) which is correlated with Boyce JM, Pittet D.et al study[11] that Gram-negative bacilli isolated from mobile phones were 100% susceptible to amikacin, meropenem,ticarcillin, piperacillin. Present study was done for microbial flora on aprons of health care workers in hospital. The most frequent type of organisms was Staphylococcus aureus in 73.5% of aprons. These results are correlated with SA Mohadi et al [12]. The second most common organism was Gram negative bacilli of Klebsiella sp(17.6%) appeared to be the most predominant organisms isolated throughout the day in the current study. These findings are similar to study conducted by Sidhartha JM, et al[13]as they says S. aureus isolated 26.4% were Methicillin- resistant S.aureus (MRSA). The MRSA has emerged as one of the major bacteria in hospital acquired infection due to regular dermal contact, dental health care professionals' aprons can harbor these resistant bacteria.

Stethoscope being one of the maximum typically used gadgets in daily clinical practice regularly gets contaminated because it comes in touch with remarkably big numbers of patients. Such scientific gadgets if not disinfected often can come to be a source of infection especially. Amongst admitted patients. Despite a huge quantity of current contamination control tips laid by means of distinctive clinical bodies global. Present study shows that stethoscopes are contaminated with potentially pathogenic microorganisms. Lavanya J et al [14] study also reported that these bacteria were isolated from contaminated stethoscopes of HCWs. correspondingly, in this study conducted in this hospital revealed that these pathogenic microorganisms are most common cause of nosocomial infection so, contaminated stethoscope can act as a source of nosocomial pathogens.

Greciaet al.[15]Study screened the stethoscopes of HCWs 69% to 87% had also been reported. These findings are consistent with contamination rate lower in our study. Due to this pandemic condition, regularly sanitize the stethoscopes. Our study found Acinetobacter spp(46.1%) as the commonest contaminant which is correlated with Pal et al[16]. while Enterococci spp (30.7%) remained the second common pathogenic bacteria being isolated from the stethoscopes.

In their study, they found the predominance of Acinetobacter spp. among the pathogenic bacteria colonizing stethoscopes, although followed by Enteococcias the second commonest. In current study bacteriologic analysis exposed that the most common isolated organism was 67% CoNS and followed by gram-negative bacteria were Pseudomonas spp on the pens. These are easily transferred from hard plastic or metal on the writing pens revealed that the pens used by HCWs were much more contaminated than those used by non-HCW counterparts [17].

In the present study, there were a greater number of bacteria isolated from under watches compared with the control sites. Study conducted by E.A. Field et. al.[18] establish that bacterial contamination is higher in wrist watches in non-clinical staffs compare with clinical staffs which is not similar to our results. Navin AIngle [19]study also shown that in both experiment groups, there were a greater number of bacteria isolated from under rings and watches compared with the control sites which is similar to current study.40%Bacillus spp isolated in watches of health care workers. Majority of bacteria isolated from HCW's key chain were Pseudomonas aeruginosa 33% in present study. Most of the gram negative bacilli sensitive to cephalosporin drugs in our study.

Conclusion

Fomites provide as a reservoir for diseases causing pathogenic microorganisms which were from surfaces of the fomites to identify the current study. Which were potential vehicles of transmission of hospital associated infections within healthcare workers. Necessitate for educating the patients and their attendees about the risk of hospital acquired infections and self-measures required to be taken by them. Monitor the screening of the hospital and its environment for the pathogenic bacteria presence.

Reference

1. Sood G, PerlTM. Outbreaks in health care settings. Infect Dis ClinN Am. 2016; 30(3):661–87.
2. Barrie D, Hoffman PN, Wilson JA, et al. Contamination of hospital linen by Bacillus cereus. Epidemiol Infect 1994; 113(2):297-306.
3. Sehulster L, Chinn RY. CDC; HICPAC. Guidelines for environmental infection control in health-care facilities: recommendations of the CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). MMWR Morb Mortal Wkly Rep. 2003; 52(RR-10):1–42.
4. Koganti S, Alhmidi H, Tomas ME, Cadnum JL, Jencson A, Donskey CJ. Evaluation of hospital floors as a potential source of pathogen dissemination using a nonpathogenic virus as a surrogate marker. Infect Control HospEpidemiol. 2016; 37(11):1374–7.
5. Brady RR, Verran J, Damani NN, Gibb AP. Review of mobile communication devices as potential reservoirs of nosocomial pathogens. J Hosp Infect. 2009; 71(4):295–300.
6. Kanayama AK, Takahashi H, Yoshizawa S, Tateda K, Kaneko A,Kobayashi I. Staphylococcus aureus surface contamination of mobile phones and presence of genetically identical strains on the hands of nursing personnel. Am J Infect Control? 2017; 45(8):929–31.
7. Sattar SA, Springthorpe S, Mani S, Gallant M, Nair RC, Scott E, Kain J.. Transfer of bacteria from fabrics to hands and other fabrics: developmentand application of a quantitative method using Staphylococcus aureus as a model.J. Appl. Microbiol. 200190:962-970.

8. Neha S, Aruna S, Parihar RS, Khatri PK, Arvind C, Archana B. Prevalence and antibiotic pattern of microbes isolated from mobile phones of health care workers and non- health care workers. IntCurr Microbiol App Sci 2014; 3: 43-60.
9. Lawani EU, Oxford IO. Mobile phones of Healthcare workers: Friend or Foe. GJRA 2015; 4(3).
10. Dardi CKG, Jaishreee SP. Study of microorganisms and their antimicrobial susceptibility pattern on mobile phones of health care workers from a tertiary care rural hospital. Adv Biomed Pharma 2015; 2: 267-273.
11. Boyce JM, Pittet D. Guideline for hand hygiene in health-care settings. MMWR Recomm Rep 2002; 51(RR-16):1-45.
12. Muhadi SA, Aznamshah NA, Jahanfar S. A cross-sectional study of microbial contamination of medical students' white coat. Mal J Microbio 2007; 3: 35-8.
13. Sidhartha JM, Reddy LVPK, Reddy YHK, Subbaiah MV. Microbiological Study of Respiratory Tract Infections in a South Indian Hospital. Research &Reviews: A Journal of Health Professions. 2019; 5(2):1-5.
14. Lavanya J, Jais M, Kumar V, Dutta R. Accessories of health care workers: a boon or a curse to patients in pediatric ICU and nursery? Int J Curr Microbiol App Sci. 2013; 2(10):441–7.
15. Grecia SC, Malanyaon O, Aguirre C The effect of an educational intervention on the contamination rates of stethoscopes and on the knowledge, attitudes, and practices regarding the stethoscope use of healthcare providers in a tertiary care hospital. Phillipp J Microbiol Infect Dis 2008 37: 20-33
16. Pal K, Chatterjee R, Biswas A, Samanta AK Bacterial Contamination and disinfection of stethoscopes: a knowledge gap among health care personnel of a tertiary care hospital of rural Bengalore 2015. IOSR-JDMS 14: 44-49.
17. Saeedeh Haghbin et al Bacterial Contamination of Mobile Phones and Pens in Pediatric and Neonatal Intensive Care Units Int. J. Curr. Microbiol. App. Sci 2015 4(2): 75-81.
18. E. A. Field, P. McGowan, P. K. Pearce, M. V. Martin: Rings and watches: should they be removed prior to operative dental procedures? J Dent 1996; 24:65-9.
19. Navin A Ingle, Alapati K Kumar, Preetha E Chaly, Chandrasekhara Reddy Contamination of Rings and Watches among Clinical and Non-Clinical Dental staffs JIOH 2012.Volume 4; Issue 2: May-Aug.