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Potency of alcohol based hand rub on personal accessories worn by Health Care Workers

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Abstract
The main aim of this study was to find out whether personal accessories of health care workers (HCWs) harbored with microbes which would inhibit good hand hygiene. A total 75 number of accessories were tested for microbes among different Health care workers (Doctors, Medical students, Nurses, Technicians, and Attenders), 25 culture swabs were taken from each of Bracelets, watches and rings. About 75% percentages were *micrococci,* 23% were Coagulase Negative *Staphylococci* and 2% were ESBL producer (*Klebsiella pneumoniae*).
Alcohol based hand rub(ABHR) is a major component of standard precautions and one of the most effective methods to prevent transmission of pathogens associated with health care setting. The use of personal protective equipment should be guided by risk assessment and the extent of contact anticipated with blood and body fluids, or pathogens. So the regular practices should be carried out by health workers while providing care, all individuals including patients and visitors should adhere with infection control practices in health-care settings. The control of spread of pathogens from the source is the key to avoid transmission.
The present study revealed the presence of bacteria in the ornaments of HCWs, which is also one of the sources of infection among HCWs. Hence the regular washing of personal accessories with Alcohol based hand rub should be made mandatory to avoid the spread of infection.

Keywords: Alcohol based hand rub, Hand colonization, Healthcare Workers, Microbes and Personal accessories.

1. Introduction
Direct contact transmission is one of the most frequent means of transmission of infectious diseases in healthcare setting worldwide [(1)].Bangle, wrist watch, rings and cell phone are the common accessories worn or carried by healthcare workers in hospital settings. Personal accessories inhibit good hand hygiene, may reduce our grip or speed while doing various manipulations, may tear or puncture gloves, may interfere with putting on glove, can become caught in beddings, dressings and even machinery. Personal accessories are a breeding ground for various disease causing microorganisms.[(2)]
Higher Bacterial colonization is seen on the hands of healthcare worker with rings and other accessories, than one without. Rings may interfere with thorough hand washing. They may cause gloves to tear. Wearing a single ring or a simple band found to be much less dangerous than wearing multiple rings or large rings with multiple stones or detailed scrollwork.[(3,4)] Elaborate hand jewelry, bracelets or bangles are known to interfere with active patient intervention. The HCWs who wear their rings/ jewellery just before a surgical procedure had higher bacterial counts than those who did not wear any accessories (Control) even after hand scrub.[(5,6,7)] In recent years, multidrug-resistant *Klebsiella pneumoniae* producing extended-spectrum β-lactamases (ESBL) have been increasingly recognized as a cause of nosocomial outbreaks worldwide, also because of the facility to acquire and to transfer the plasmidic resistances.[(8)]
The aim of the study is to assess the effect of ring, bracelet and watch wearing on hand contamination and efficacy of alcohol-based hand disinfection among Doctor, Medical students, Nurses, Technicians and Attenders working in hospital settings.

Material and methods
A cross sectional study was conducted from March 2015 to May 2015 at Shri Sathya Sai Medical College and Research Institute. Seventy five accessories (25 Rings, 25 Watches and 25 Bracelets) from 5 Doctors,5 Medical students, 5 Nurses,5 Technicians and 5 Ward Attenders were examined for the presence of bacteria. samples were selected through Disproportionate Random Sampling. The research design is Descriptive in nature.

The swabs were taken from the accessories, transported to microbiology laboratory of SSSMC & RI, cultured in blood agar, Mac Conkey agar and incubated at 37'C till 48 hour. Identification of the growth was done by standard microbiological methods.[9] Antibiotic sensitivity tests were done for the isolated bacteria using Kirby Bauer disc-diffusion method.[10]

People were excluded if they had skin irritation or eczema, if they had taken antibiotics during the previous 2 weeks or had performed surgical hand disinfection during the preceding 24 hours.

Results

Following observations were identified in our study. Overall 75 of accessories were tested for microbes among which 25 on ring, 25 on wrist watches and 25 on bracelets. About 75% percentages were *micrococci*, 23% were Coagulase Negative *Staphylococci* (CONS) and 2% were ESBL producer (*Klebsiella pneumoniae*). **(Table 1 & Figure 3, 4)**This work is done to compare directly the level of contamination of Health care workers ornaments before and after using Alcohol based hand rub.

We have proved in our study, before disinfecting the health care workers ornaments, organisms were found to be 17%for Doctors, 24%for Medical students, 23% for Nurses,18%for Technicians, 18% for Attenders,**(Table 2 & Figure 1, 5)** but after disinfecting the ornaments with alcohol based hand rub, there was no growth found in all the plates.(**Figure 2**) Therefore, Health care workers must be aware of the need to disinfect their ornaments after each use.

The isolation of *micrococci* was seen to a greater extent among the HCWs followed by Coagulase Negative *Staphylococci* and ESBL producer (*Klebsiella pneumoniae*). The Medical students and Nurses wearing ornaments showed more bacterial colonization than the other HCWs. Hence this study brings out the importance of providing awareness regarding the use of Alcohol based hand rubs to health care personnel which would lead to reduction in infections.

Among health care workers, wearing of ring, bracelet and watch can transmit the pathogenic organisms. Therefore, ornaments should not be worn by healthcare professionals providing direct patient care unless required for patient care. Pathogenic microorganisms were exclusively found on ornaments of healthcare workers who wore jewellery. These must be removable and able to be cleaned with proper Alcohol-based hand rub after each use. In our study we are recommending the health care workers, while handling the patients, excessive jewellery should be avoided.

Healthcare facilities must ensure that ABHRs (Alcohol-based hand rubs) dispensers are accessible in the patient zone. Moreover, hand washing plays crucial role in preventing the spread of disease and it should be highlighted. Hands must be washed for at least 20-25 seconds. Five rules of Hand wash, according to WHO, should be recommended, after and before patient contact, before aseptic task after body fluid exposure, after patient contact and after contact with patient's surroundings. [11]

Alcohol based hand rubs (ABHR) lyse (destroy) bacterial cells leading to denaturation and coagulation of proteins within the cell and cell death. Alcohol based hand rub is the recommended product for hand hygiene provided hands are not soiled or visibly dirty.[12]In our opinion the effectiveness of alcohol-based hand rubs, strongly recommended by the World Health Organization (WHO), must be associated with educational interventions about their use and about the importance of hand hygiene.

Several randomized clinical trials, systematic and non-systematic reviews and observational studies have described that alcohol based hand rubs are more effective at reducing bacterial colony counts on hands compared with hand washing with soap and water [13].In addition, there is a body of evidence generated through experimental laboratory studies demonstrating the efficacy of alcohol based hand rubs for hand hygiene.[14]

Table 1: Distribution of bacterial growth on different accessories

Types of Organism	Rings	Watches	Bracelets	Percentage
Micrococci	20	15	10	75%
Staphylococci	3	6	5	23%
ESBL(Klebsiella pneumoniae)	-	1	-	2%

Table 2: Percentage of bacterial growth from different HCWS

Hcws	No: Of Samples	Rings	Watches	Bracelets	Total no: of organisms isolated	percentage
Doctors	5	3 *Micrococci*,	2 *Micrococci* 3 *Staphylococci*,	2 *Micrococci*,	10	17%
Medical students	5	5 *Micrococci*	3 Micrococci, 1 *Klebsiella pneumoniae* (ESBL)	4 *Micrococci*, 1 *Staphylococci*,	14	24%
Nurses	5	5 *Micrococci*,	3 *Micrococci*, 2 *Staphylococci*,	2 *Micrococci*, 2 *Staphylococci*,	14	23%
Technicians	5	2 *Micrococci*, 3 *Staphylococci*	3 *Micrococci*	1 *Micrococci*, 2 *Staphylococci*,	11	18%
Attenders	5	5 *Micrococci*,	4 *Micrococci*, 1 *Staphylococci*,	1 *Micrococci*,	11	18%

Fig1: Before using Hand rub shows bacterial growth on Mac Conkey and sheep Blood agar plate.

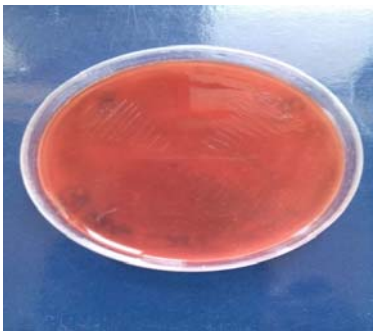

Fig 2: After using Hand rub shows no bacterial growth in Blood agar

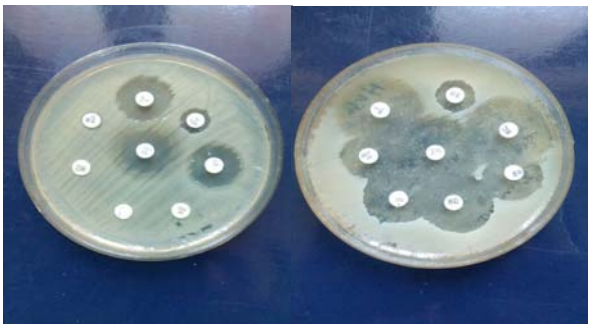

Fig 3: Antibiotic sensitivity pattern showing ESBL and CONS

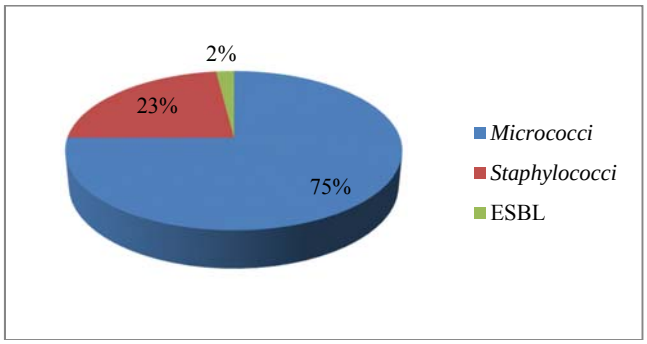

Fig. 4: Prevalence of bacterial identification in ornaments

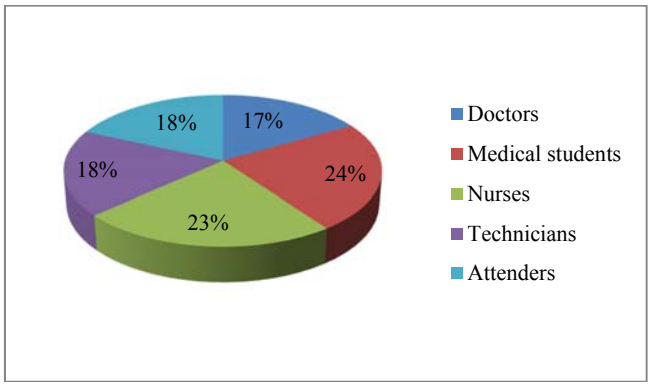

Fig 5: Distribution of microbes from HCWs

Discussion

In our present study, three important groups of bacteria were isolated from 75 number of the personal accessories: They were Micrococcus and coagulase negative *Staphylococci* ESBL producer (*Klebsiella pneumonia*).

Micrococcus spp and closely related genera though considered harmless saprophytes that inhabit or contaminate the skin, mucosa, and oropharynx; however, they can be opportunistic pathogens for the immunocompromised individuals.[15] They have been associated with various infections, including bacteremia, continuous ambulatory peritoneal dialysis peritonitis, and infections associated with ventricular shunts and central venous catheters. They have also been isolated from blood and surgical specimens in some patients with coronary and infectious conditions. *M. luteus* has been reported as the causative agent in cases of intracranial abscesses, pneumonia, septic arthritis, endocarditis, and meningitis.[16,17]

Coagulase-negative *Staphylococci* have long been regarded as a pathogenic but their important role as pathogens and their increasing incidence have been recognized and studied in recent years. Although specific virulence factors are not as clearly established as they are in *Staphylococcus aureus*, it seems clear that factors such as bacterial polysaccharide components are involved in attachment and/or persistence of bacteria on foreign materials. Coagulase-negative *staphylococci* are by far the most common cause of bacteremia related to indwelling devices.

Most of these infections are hospital-acquired, and studies over the past several years suggest that they are often caused by strains that are transmitted among hospitalized patients. Other important infections due to coagulase-negative *Staphylococci* include central nervous system shunt infections, native or prosthetic valve endocarditis, urinary tract infections, and endophthalmitis. Intravenous treatment of

systemic infections is usually required because coagulase-negative *Staphylococci* have become increasingly resistant to multiple antibiotics.[18]

The issue of ESBL production is one that is not going to go away and indeed, as presented here, may well be increasing at different rates throughout the world. ESBL-producing Enterobacteriaceae infection among health care workers is increasing. Of all aerobic gram-negative bacilli, *E. coli* and *Klebsiella species* most frequently cause disease in humans, with the most common sites of infection being the urinary tract, biliary tract, gastrointestinal tract, and wounds due to trauma. Bacteremia, hospital-acquired pneumonia, postoperative meningitis, and other nosocomial infections produce life-threatening disease.[19,20] Our study correlates with above mentioned studies.

Even in the English guideline states that wrist jewellery should be removed prior to patient contact (Pratt et al. 2007).[21]only two studies have previously been published on this issue. Field et al. (1996)[22] found that skin below wrist watches harbors more bacteria than control skin on the opposite wrist. The CDC states that no recommendation can be made about wearing rings in healthcare settings, and that this is an unresolved issue (Boyce & Pittet 2002).[23] WHO recommends the removal of rings or other jewellery during health care, but accept the use of simple wedding band during routine care based on strong religious or cultural influences (World Health Organization 2009).[24]

Our results support this recommendation. Even several studies have shown that skin underneath rings is more heavily colonized than comparable areas of skin on fingers without rings. Wearing of rings in clinical areas must be limited to a plain band on the finger and this should be moved about on the finger during hand hygiene.

Conclusion

Health care-associated infections constitute one of the greatest challenges of modern medicine. HCWs accessories can serve as a vehicle for cross-contamination of bacterial pathogens in medical settings. We demonstrated that bacteria not only survive on ornaments but can also be transferred from one person's hands to ornaments and back to another person's hands. It is also important to remove ornaments when treating each patient contact and to use hand-hygiene procedures after ornament removal.

Despite compelling evidence that proper hand washing can reduce the transmission of pathogens to patients and the spread of antimicrobial resistance, the adherence of health care workers to recommended hand-hygiene practices has remained unacceptably low.

An alcohol-based hand rub requires less time and is microbiologically more effective, and is less irritating to skin than traditional hand washing with soap and water. Therefore, alcohol-based hand rubs should replace hand washing as a standard practice for hand hygiene in health care settings in all situations in which the hands are not visibly soiled.

Moreover, experience from outbreaks suggests that targeted surveillance and introduction of strict infection control measures (such as improved hand hygiene and contact precautions) can help control the spread of ESBL-*Klebsiella pneumoniae*.[8]More than that microbiology laboratories and clinicians need to be aware of the presence of ESBL-producing organisms in their hospital and should follow the proper infection control measures.

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