International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

A Cross - Sectional Study to Assess the Compliance of Use of Hand Rub as a Hand Hygiene Practice among Health Care Workers of ICU in a Tertiary Care Hospital in Lucknow

ICU UPDATE TRAINEES

Seema Kumari Singh [1], Sanju Kumari[2], Neha[3], Gabriella Rynjah[4], Rekha Kumari [5]

Abstract: ***Background: With increase in burden of nosocomial infections, there is an increase in rate of patient succumbing to death in critical care units of hospital in developing countries due to complications of hospital acquired infections. Nosocomial infections increase the hospital stay, mortality rates and financial burden to the organisation. There is a frequent contact between hospitalised patients and health care workers in terms of carrying out diagnostic procedures, providing therapeutic care and direct patient care in ICU set up. On May 5, 2009, the WHO highlighted the importance of hand hygiene and launched guidelines and tools on hand hygiene, "Save Lives": Clean your hands. Alcohol based hand-rubs were equally effective in prevention of nosocomial infections and occupational infections apart from handwashing as it overcomes all infrastructural barriers & time barriers related to handwashing. Objective: To assess the hand rub practices followed by health care workers in ICU in adherence to five moments of hand hygiene practices given by WHO. Methods: An observational checklist based on WHO five moments of hand hygiene in health care services related to alcohol based hand-rub 2009 was used among 50 professional health care workers using non participant random sampling by a single observer from 0900- 1030 hrs during morning hours over 10 days in Mar 2020 in ICU. The five moments were before touching the patient, before clean and aseptic body procedures, after body fluid exposure risk, after touching a patient and after touching patient surroundings. The alcohol based hand-rub used was Sterilium. Five moments were considered as opportunities and each moment was given score of 01.Compliance was taken as adherence to these moments. Missed opportunities were also recorded in terms of not following the adherence to these moments. The overall compliance rate of hand-rub among all HCWs and compliance specific to each moment was assessed. Results: In this study, All HCWs 50 selected on random basis were professional and registered under their respective councils. Most of the HCWs, 37% belonged to age group of 30-39 yrs and the majority of HCWs, 60 % were nurses and maximum, 34% subjects had 1-5 yrs of experience. As per professional qualification, 38% were postgraduates, 38% had diploma degree and 24% of subjects were graduates in their respective field of profession. The maximum overall compliance rate in relation to five moments was 54% among paramedics who were operating room attendants, diploma holders and working in OT for a longer period of time followed by compliance rate of 44% among nurses and least of 15% was observed among doctors. However, maximum nurses were diploma holders and graduates. A large number of doctors were postgraduates. More compliance (86%) was observed in the specific moment of hand-rub i.e. before clean and aseptic procedure followed by 58 % compliance in the moment of after patient contact among all HCWs. In after body fluid exposure risk, compliance observed was 27.9 % among HCWs. The least compliance of 10 % was seen in two moments out of five i.e. before patient contact and after touching patient surroundings. Thus, knowledge is important for hand-rub practices but more important is to emphasise on strict adherence practices to this alcohol based hand-rubs as per five moments given by WHO. In our study increased workload over nurses in ICU many a times became a barrier in adherence to hand-rub practices. Conclusion: The result of improved overall compliance of hand-rub in paramedics (ORAs) over nurses and doctors may be attributed to decreased workload of patient care over them in addition to strict aseptic techniques being followed by then in operation theatre. Awareness, Knowledge, years of experience and infection control skills of HCWs will be affected if workload of patient care is being overlooked.***

Keywords: Nosocomial infections, alcohol based handrubs, five moments of WHO, Intensive care unit, compliance, Health care workers

1. Introduction

With increase in burden of nosocomial infections, there is an increase in rate of patient succumbing to death in critical care units of hospital in developing countries due to complications of hospital acquired infections. Nosocomial infections increase the hospital stay, mortality rates and financial burden to the organisation.

There is a frequent contact between hospitalised patients and health care workers in terms of carrying out diagnostic procedures, providing therapeutic care and direct patient care in ICU set up. The inadequate compliance of hand hygiene practices among health care workers in relation to increased nosocomial infection rates in intensive care units paves a path for assessment of hand hygiene practices as they are generally found to be lower in critical care set up because of fast turn over of patients, inadequately trained staff, lack of structured teaching programmes, increased workload of patient care on staff, unavailability of hand rubs, myths regarding the use of hand rub, allergies to hand rubs, frequent life saving emergency procedures, lack of conditioned training and reminder protocols of hand rubs among health care workers.

Hand hygiene is considered to be very essential in prevention of nosocomial infections. According to WHO 2010, hand hygiene is considered to be a primary measure for reducing the risk of transmitting infections among patients and health care personnel. Hand hygiene practices include the use of alcohol based hand rub (containing 75% isopropanol or ethanol v/v) and hand washing with soap and water.

Unless hands are visibly soiled with dirt, blood, body fluids etc, an alcohol-based hand rub can be practiced over soap and water in most of the clinical situations because it;

- Is more effective than soap at killing potentially deadly germs on hands.
- Is more accessible than hand washing sinks.
- Produces reduced bacterial counts on hand.
- Improves skin condition with less irritation and dryness than soap and water.

Hand hygiene is regarded as one of the most important element of infection control. In today's world of growing burden of health care associated infections and other severe viral outbreak e.g. COVID-19 outbreak, the increasing severity of illness and complexity of treatment, multi drug resistant infections, hand hygiene practices have become mandatory for everyone.

In the present scenario, the health care providers are giving importance to hand hygiene practices in view of enough scientific evidences in support of alcohol based hand-rub. These practices if implemented can significantly reduce the risk of cross transmission of infection in health care facilities. World Health Organisation (WHO) introduces "My five moments of hand rub" to minimise the problems related to prevention and control of infections. These five moments are before touching the patient, after touching the patient, before performing aseptic and clean procedures, after being at risk of exposure to body fluids, after touching patient surroundings.

2. Background of the Study

The significance of hand washing in patient care was conceptualized in the early 19th century. Labarraque provided the first evidence that hand decontamination can markedly reduce the incidence of puerperal fever and maternal mortality. In 1995, the hospital infection control practices advisory committee advocated the use of antimicrobial soaps and waterless antiseptic agent for cleaning hands. In 1995, the Hospital Infection Control Practices Advisory Committee advocates the use of antimicrobial soap or a waterless antiseptic agent for cleaning hands upon leaving the rooms of patients infected with multidrug- resistant pathogens. In 2002, the CDC published revised guidelines for hand hygiene. A major change in these guidelines was the recommendation to use alcohol based hand rubs for decontamination of hands between each patient contact (of non soiling type) and use of liquid soap and water for cleaning visible soiled hands. Evaluation of processes and indicators in infection control study concluded that there was a good evidence that direct patient contact results in hand contamination by pathogens. The EPIC study also shows the superiority of 70% alcohol or alcohol based hand-rubs. In 2005, WHO introduced the first Global Patient Safety Challenge "Clean Care Is Safer Care", as part of its world alliance for patient safety. In 2006, advanced draft guidelines on" hand hygiene in health care" were published and a suite of implementation tools were developed and tested. The first global hand washing day was observed on October 15, 2008. A WHO patient safety initiative has been established to catalyse this progress. On May 5, 2009, the WHO highlighted the importance of hand hygiene and launched guidelines and tools on hand hygiene, based on next phase of patient safety work programme "SAVE LIVES": Clean your hands. Alcohols such as ethanol are well known antimicrobial agents and were first recommended for the treatment of hands in 1888. The highest efficacy towards antimicrobial can be achieved with the use of ethanol (60-85%), isopropanol (60-80%), and n-propanol (60-80%). The activity is broad and immediate. Ethanol, the most common alcohol ingredients, appears to be the most effective against viruses; whereas, the propane's have a better bacteriocidal activity than ethanol. None of the alcohols has shown a potential for acquired bacterial resistance. The concentration of alcohol does change the efficacy with one study showing a hand rub with 85% ethanol being significantly better at reducing bacterial populations compared to concentrations of 60% to 62%.

3. Need of the Study

As per WHO, hundreds of millions of patients are affected by health care associated infections worldwide each year, leading to significant mortality and financial losses for health systems. Of every 100 hospitalized patients at any given time, 7 in developed and 10 in developing countries will acquire at least one health care-associated infection. The endemic burden of health care-associated infection is also significantly higher in low- and middle-income than in high-income countries, in particular in patients admitted to intensive care units and in neonates. In high-income countries, approximately 30% of patients in intensive care units are affected by at least one health care-associated infection. In low and middle income countries the frequency of ICU acquired infection is at least 2 to 3 fold higher than in high income countries; device-associated infection densities are up to 13 times higher than in the United States of America.[1]

As per CDC, on any given day, about one in 31 hospital patients has at least one healthcare-associated infection. Patients in the 2015 HAI Hospital Prevalence survey were at least 16% less likely than patients in the 2011 survey to have an HAI. 3% of hospitalized patients in the 2015 survey had one or more HAI.[2]

A number of infectious diseases can be spread from one person to another by contaminated hands. These diseases include gastrointestinal infections, such as salmonella, and respiratory infections such as influenza, novel COVID-19 outbreak and many other hospital acquired infections which impose health hazards not only to patients, hospital staff but also hospital organisation financially in terms of its resources. Proper hand hygiene practices can prevent the spread of the germs that causes these diseases. Hand hygiene with alcohol based rubs is more effective and less time consuming, easily available in patients vicinity and most suitable in hospital setup with increased workload of patients. Handwashing is difficult to be practiced very frequently and practically in ICU set up meant for handling many life saving procedures in critically ill patients and whereby due to infrastructural problems for example unavailability of washbasins in nearby vicinity of patient

care, adequate clean water for 24 hrs, availability of soap and most important adequate time for hand washing are lacking. The alcohol based hand rub acts by denaturing the cell wall and therefore deactivating the bacterias and microbes. There are two types of microbes colonising hands: the resident flora, which consists of microorganism residing under the superficial cells of the stratum corneum and the transient flora which colonies the superficial layers of the skin, and is more amenable to removal by routine hand hygiene. Transient micro organisms survive, but do not usually multiply on the skin. They are often acquired by health care workers during direct contact with patients or their nearby contaminated environmental surfaces and are the organism most frequently associated with hospital acquired infections. Several studies have demonstrated that hand washing virtually eradicates the carriage of MRSA which invariably occurs on the hands of health care workers working in ICUs. An increase in hand hygiene compliance has been found to be accompanied by a fall in MRSA rate. The hand hygiene liaison group identified nine controlled studies, all of which showed significant reduction in infection related outcomes even in settings with a high infection rates in critically ill patients. Hand hygiene is considered to be very essential in prevention of nosocomial infections. WHO enforces the use of hand rub and hand washing as hand hygiene practices in the prevention and spread of nosocomial infections in hospital. So, it becomes important to emphasise on hand hygiene practices in hospital setup to decrease the load of hospital acquired infections.

Problem statement

A cross-sectional study to assess the compliance of use of hand rubs as a hand hygiene practice among health care workers in ICU of a tertiary care hospital in Lucknow.

Objectives of the study

To assess the existing hand rub practices followed by health care workers in ICU in adherence to five moments of alcohol based hand rub practices as per WHO guidelines.

Operational definitions

Hand rub: According to Oxford Advanced Learners Dictionary, it means to move your hand backwards and forward over a surface while pressing it. In this study, it refers to hand rub using Sterilium, an alcohol based hand rub having formulation: 2-propanol, 45 gram and 1-propanol, 30 gram.

Compliance: According to Oxford Advanced Learners Dictionary, compliance means the practice of obeying rules or requests made by people in authority. In this study, it means adherence to the five moments of alcohol based hand rub as per WHO guidelines.

Hand hygiene practices: A general term referring to any action of hand cleansing. As per WHO, hand washing & hand rubbing are two ways of hand hygiene practices. In this study, hand hygiene practices refers to use of alcohol based hand rub as per five moments of hand hygiene in health care services, 2009 given by WHO are as follow :

1) Before touching a patient
2) Before clean/aseptic procedures
3) After body fluid exposure
4) After touching patient
5) After touching patient's surroundings

Compliance: According to Oxford Advanced Learners Dictionary, compliance means the practice of obeying rules or requests made by people in authority. In this study, it means adherence to the five moments of hand rub as per WHO guidelines.

Health care worker: According to Harper Collins Dictionary, health care worker means someone who works in a hospital or health centre. In this study, it refers to all professional doctors, nurses and paramedical staff who are registered under statutory bodies of medical, nursing and paramedical council and also working in ICU.

Intensive care unit: As per College of Intensive Care Medicine of Australia and New Zealand, An intensive care unit (ICU) is a specially staffed and equipped, separate and self contained area of a hospital dedicated to the management of patients with life threatening illnesses, injuries and complications and monitoring of life threatening conditions. It provides special expertise and facilities for support of vital functions and uses of the skill of medical, nursing and other personnel experience in the management of these problems.

In this study, it includes Medical, Surgical, Step down and Cardiac care units of Intensive care units intended to provide patient care to critically ill patients.

Scope of the study

The findings of this study would help the health care workers in improving their hand hygiene practices after acknowledging the compliance rate of alcohol based hand-rub practices among HCWs in ICU. This study will help in conducting researches on effectiveness of hand-rub based hand hygiene practices as hand-rub is easily available in critical care units. It will also help in conducting structural teaching programmes on hand rub based hand hygiene practices which will help in prevention & control of nosocomial infections in health care system and also will help in prevention of occupational infections among HCWs. The findings of the study have implication in the field of health administration, nursing practices, nursing education and Hospital Infection Control Committe. Easy availability of adequate hand-rubs, institutional motivation in use of hand-rubs in relation to five moments of hand hygiene practices given by WHO can be implied upon by administration. Apart from this, studies on easy availability of alcohol based hand-rubs in improving hand hygiene compliance rate among HCWs in clinical care units of hospital can be emphasised upon.

Assumptions

1) All professional health care workers are assumed to have awareness regarding 5 moments of hand rub as per WHO.

2) Professional health care workers by virtue of their knowledge, training and experience are assumed to have better compliance to hand rub practices.
3) All professional health care workers are assumed to be well acquainted with hand rub practices in intensive care units of this selected tertiary care hospital creating awareness among HCWs on hand-rub practices as per WHO through display of posters on hand-rubs and pressing reminder bells frequently in ICU for use of hand-rubs.

Delimitation
Short duration of study.

Ethical aspects
Ethical aspect of conducting research has been taken into consideration in each step of study. Prior permission has been taken from the head of this institution to conduct the study. Non participant observation study was carried out without knowledge of health care workers, so as to provide unbiased random data collection. Institutional ethical clearance was obtained. Selection of research participants were based on research requirement and not on any preconceived ideas. Investigators treated every participant equally. Subjects were protected from physical and psychological harm. Non-judgemental, non-punitive and non- argumentative approach was followed during data collection. Anonymity and confidentiality were maintained by not using their name but only using service number.

4. Review of Literature

A literature review is a "critical analysis of a segment of a published body of knowledge through summary, classification, and comparison of prior research studies, reviews of literature, and theoretical articles".
- University of Wisconsin Writing Center

A literature review is an evaluative report of information found in the literature related to selected area of study. The review describes, summarizes, evaluates and clarifies this literature. It gives a theoretical base for the research and helps to determine the nature of research -
Queensland University, 1999

A literature review should help to identify, evaluate and synthesize the relevant literature within a particular field of research. It illuminates how knowledge has evolved within the field, highlighting what has already been done, what is generally accepted, what is emerging and what is the current state of thinking on the topic. It should provide a theoretical base for the research and help to determine the nature of research. All works included must be read, evaluated and analysed but relationship between the literature must also be identified in the field of research.

The review of literature has been divided under the following sections:
a) Compliance of hand rub among health workers
b) Use of hand rub as a hand hygiene practice
c) Hand rub used in critical care units
d) Use of five moments of hand hygiene practice as per WHO

Compliance of hand rub among health care workers
World Health Organisation in 2009, estimates that hand hygiene performance varies according to work intensity and several other factors. Health Care Workers cleaned their hands on an average from 5 to as many as short as 6.6 seconds to 30 seconds. The use of an alcohol-based hand-rub is the preferred means for routine hand antisepsis in all other clinical situations.

A prospective descriptive study conducted by Rejani R on hand hygiene among health care workers in a tertiary care hospital in 2017 using a questionnaire and an observation tool among 30 HCWs revealed that 50% of subjects used soap and water alone for hand hygiene, 53.33% used alcohol based hand-rub. Nurses showed more overall hand hygiene compliance of 90.8 % followed by 83.78% among paramedical nursing staff and least 74.6 % among doctors. Hand hygiene compliance was more than 75% in four out of five situations and nurses showed more compliance 90.82% than other HCWs.100% compliance was seen in moment of after contact with body fluids and 60.76 % compliance was observed among HCWs in the moment of after touching patient surroundings.[3]

A cross-sectional study conducted by Anargh V on hand hygiene practices among health care workers in a tertiary care hospital in 2013 using a questionnaire and an observation tool among 100 HCWs revealed that WHO guidelines regarding procedures were being followed by 90% for hand washing with soap and water and 64% for alcohol based rubs. 21% HCWs were missing hand hygiene opportunities 1 in 5 times.[4]

A cross-sectional study conducted by Yawson AE, Hesse JE on Hand hygiene practices and resources in a teaching hospital in Ghana in 2013 using an observational tool revealed that hand hygiene compliance of doctors ranged from 9.2% to 57% and 9.6% to 54% among nurses.

A prospective and observational study conducted by Bischoff E, Reynolds TM, Sessler CN, Edmond MB, Wenzel RP on Hand washing compliance by health care workers-The impact of introducing an accessible alcohol based hand-rub in 2000 using an observation tool showed handwashing compliance before and after defined events was 9% and 22% for health care workers in the medical ICU and 3% and 13% for health care workers in the cardiac surgery ICU respectively. After the education/feedback intervention program, handwashing compliance changed little (medical ICU, 14% [before] and 25% [after]; cardiac surgery ICU, 6% [before] and 13% [after]). Observations after introduction of the new, increasingly accessible, alcohol-based, waterless hand antiseptic revealed significantly higher handwashing rates ($P<.05$), and handwashing compliance improved as accessibility was enhanced-before 19% and after 41% with 1 dispenser per 4 beds; and before 23% and after 48% with 1 dispenser for each bed.[5]

Use of hand-rub as hand hygiene practice
World Health Organisation in 2009 reveals that when HCWs hands are heavily contaminated, alcohol-based hand-rubbing can prevent pathogen transmission more effectively than

handwashing with plain soap and water**.** The antimicrobial activity of alcohols results from their ability to denature proteins containing 60-80% alcohols and are most effective, with higher concentration being less potent.

A Quasi-experimental study conducted by Keller J, Wolfensberger A, Clack L, Stefan P, Kuster, Dunic M, Eis D et al on Do wearable alcohol-based hand-rub dispensers increase hand hygiene compliance? in 2018 using an observation and a questionnaire tool among 800 HCWs showed that across 811 observed HH opportunities, the HH compliance for all moments was 56% (95% confidence interval (CI), 51–62%) during baseline and 64% (CI, 59–68%) during intervention period, respectively. In the multivariable analysis adjusted for sex, profession, and WHO HH moment, there was no difference in HH compliance between baseline and intervention (adjusted Odds ratio: 1.22 (0.89–1.66), $p = 0.22$). During intervention, 7.5% ABHR was consumed using wearable dispensers. Poor ergonomic design of the wearable dispenser emerged as a main barrier, especially its lid and fastening mechanism. [6]

A Quasi-experimental study conducted by Saito H, Inoue K, Ditai J, Wanume B, Abeso J, Balyejussa, Weeks A on Alcohol-based hand rub and incidence of healthcare associated infections in a rural regional referral and teaching hospital in Uganda ('WardGel' study) in 2017 using an observational study during 12-week intervention phase where training for HH practice was provided to all HCWs present on the target wards and ABHR was supplied to the wards. Incidence of HAIs and or Systemic Inflammatory Response Syndrome (SIRS) was measured and compared between the baseline and intervention phases. Multivariate survival analysis was performed to identify associated variables with HAIs/SIRS.A total of 3335 patients (26.3%) were enrolled into the study from a total of 12, 665 admissions on the study wards over a 24-week period. HH compliance rate significantly improved from 9.2% at baseline to 56.4% during the intervention phase ($p < 0.001$). The incidence of HAIs/SIRS was not significantly changed between the baseline and intervention phases.[7]

An experimental study conducted by Pires D, Soule H, Bellissimo-Rodrigues F, Gayet-Ageron A, Pittet D on Hand Hygiene With Alcohol-Based Hand Rub: How Long Is Long Enough? in 2017 using a generalized linear mixed model with a random effect on the subject adjusted for hand size and gender was used to analyze the reduction in bacterial counts after each hand-rubbing action. In addition, hand-rubbing durations of 15 and 30 seconds were compared to assert non-inferiority (0.6 log10). RESULTS In total, 32 HCP performed 123 trials. All durations of hand rubbing led to significant reductions in bacterial counts (P<.001). Reductions achieved after 10, 15, or 20 seconds of hand rubbing were not significantly different from those obtained after 30 seconds. Hand rubbing for 15 seconds was not inferior to 30 seconds in reducing bacterial counts on hands under the described experimental conditions. There was no gain in reducing bacterial counts from hand rubbing longer than 30 seconds.[8]

A systematic review conducted by Picheansathian W on Alcohol-based solutions for Hand Hygiene: A Systematic Review in 2004 using meta-analysis of use of alcohol-based solutions for routine hand hygiene and surgical hand scrub among HCWs. Alcohol-based hand rub removes microorganisms from hands of personnel more effectively, requires less time, and irritates hands less often than traditional handwashing with nonmedicated soap or other antiseptic agents and water. The combination of 61% ethanol and 1% chlorhexidine gluconate (CHG) is even more effective in producing residual antibacterial properties on the skin. Furthermore, the availability of bedside alcohol-based solutions increased compliance with hand hygiene among HCWs.[9]

Hand-rub used in critical care unit

According to the US CDC, roughly 1 in every 25 patients acquires a health care-associated infection during their hospital care and around 30% of patients in ICU are mostly affected. Therefore, hand hygiene practice important in preventing healthcare associated infections. Low compliance to hand-washing or use of alcohol based hand-rub results in increased chances of mortality rate in patients.

A cross-sectional study conducted by Sharma S, Sharma S, Puri S, Whig J on Hand hygiene compliance in the intensive care units of a tertiary care hospital in 2011 among 114 HCWs using a questionnaire and an observational tool revealed that the overall compliance was 43.2% (394/911 opportunities). It was 68.9% (31/45) in the intensivists, 56.3% (18/32) in attending physicians, 40.0% (28/70) in the postgraduate residents and 41.3% (301/728) in the nurses. Compliance of the study group is affected by the activity index (number of opportunities they come across per hour) and professional status. The HCWs listed less knowledge, lack of motivation, increased workload as some of the factors influencing HH.[10]

A study conducted by Tschudin-Sutter S, Pargger H, Widmer AF on Hand hygiene practices in an intensive care unit in 2010 among 38 HCWs using an observation tool reveals that an increased use of alcoholic hand-rub lead to an increase compliance of healthcare workers with the recommended hand hygiene practices from 47% to77% and a reduced rate of nosocomial infection.

An observational study conducted by Maury E, Alzieu M, Baudel JL, Haram N, Barbut F, Guidet B, Offenstadt G on Availability of an alcohol solution can improve hand disinfection compliance in an intensive care unit in 2000 using a questionnaire and observational tool reveals that the general compliance of hand hygiene increased from 42.4% to 60.9% after the introduction of alcohol solution for hand hygiene during two phases.The general compliance with hand disinfection was 42.4% during phase 1 (P1) and 60.9% during phase 2 (P2) ($p = 0.001$). The increase in compliance from P1 to P2 was also observed in each professional category as follows: paramedical staff, from 45.3% to 66.9%; physicians, from 37.2% to 55.5%; residents, from 46.9% to 59.1%.[11]

Use of Five Moments of hand hygiene as per WHO

According to the WHO, there are 14 million cases of HAIs at any given time and account for 80, 000 fatalities each year in the US alone. Utilizing the five moments of hand hygiene

helps in reducing the risk of contamination at a critical moment of patients care. According to a recent study, moments two and three before procedures and after body fluid exposure involve a greater chance of contamination. These 'riskier' moments were found to be the most missed 'inside room' hand hygiene opportunities.

A cross-sectional study conducted by Asma F A, Kheraiji, Bashayer, A lMalki, Nuha S, A Hammad et al on Assessment by WHO's My 5 moments of Hand Hygiene shows inadequate knowledge and its translation into practices for hand washing behaviour among Saudi medical students in 2017 among 269 medical students using a questionnaire and an observational tool revealed that only 47% of the students achieved the highest score for questions on both knowledge and attitude while no more than 35 % attained full score for practice indicating inadequacy in comprehensiveness. The study showed significant gender differences in all the mean scores where female students score were higher than males for knowledge, attitude and practices for hand hygiene practices. The study showed significant gender differences in all the mean scores where females scored higher than males for knowledge, attitude and practices for hand hygiene practices.[12]

A cross-sectional study conducted by Sunkesula VC, Meranda D, Kundrapu S, Zabarsky TF, McKee M, Macinga DR, Donskey CJ on Comparison of hand hygiene monitoring using the 5 Moments for Hand Hygiene method versus a wash in-wash out method in 2015 using an observational tool revealed that for 283 health care worker room entries, the methods resulted in similar rates of hand hygiene compliance (70% vs 72%, respectively). The wash in–wash out method required 148 hand hygiene events not required by the My 5 Moments for Hand Hygiene method i.e, before and after room entry with no patient or environmental contact) while not providing monitoring for 89 hand hygiene opportunities in patient rooms.[1]

A cross-sectional study conducted by Kenneth I, Onyedibe, Nathan Y, Shehu, Daniela Pires, Samson E et al on Assessment of hand hygiene facilities and staff compliance in a large tertiary health care facility in northern Nigeria: a cross sectional study among 175 HCWs in 46 clinical units including ICU of the hospital. 72% of the units had no poster or written policy on HH; 87% did not have alcohol-based hand rubs; 98% had at least one handwash sink; 28% had flowing tap water all day while 72% utilized cup and bucket; and 58% had no hand drying facilities. A total of 406 HH opportunities were observed among 175 HCWs. The overall compliance was highest, 82% among medical students, followed by nursing students, nurses and least in ward attendant. Based on WHO "5 moments" for HH, average compliance was 21% before patient contact, 23% before aseptic procedure, 63% after body fluid exposure risk, 41% after patient contact and 40% after contact with patients' surrounding.[14]

A descriptive cross-sectional study conducted by Jemal S on knowledge and practices of hand washing among health professionals in Dupti referral hospital Ethiopia in 2008 among 92 respondents shows that only 33 (36.3%) always wash their hands before clean and aseptic procedures. Only 18 (19.8%) of them always wash their hands before and after individual patient contact. 25 (27.5%) always used alcohol-based hand rub for hand hygiene. Also only 21 (23.1%) washed hands before contact with patients. However, 71 (78%) washed their hands after contact with body secretions.[15]

5. Methodology

The research methodologies are the procedures by which researchers plan and go systematically to obtain answers to research questions about their work of describing, explaining and predicting phenomenon. This is conducted to develop, validate, test and evaluated the research instruments and methods used for the study. This chapter deals with the brief description of the methodology adopted for the study which consists of the research, research design, research setting of the study, sampling, sample technique, data collection, tool and technique and plan for the data analysis of the study.

Present study is to assess the hand rub practices followed by health care workers in ICU in adherences to five moments of hand rub practices as per WHO guidelines.

Objectives of the study were

To assess the hand rub practices followed by health care workers in ICU in adherence to five moments of hand rub practices as per WHO guidelines.

Assumptions

1) All professional health care workers are assumed to have awareness regarding 5 moments of hand rub as per WHO.
2) Professional health care workers by virtue of their knowledge, training and experience are assumed to have better compliance to hand rub practices.
3) All professional health care workers are assumed to be well acquainted with hand rub practices in intensive care units of this selected tertiary care hospital creating awareness among HCWs on hand-rub practices as per WHO through display of posters on hand-rubs and pressing reminder bells frequently in ICU for use of hand-rubs.

Research approach

It involves the description of plan to investigate the phenomena under study.It is a quantitative, cross-sectional study conducted in ICU using observational checklist for assessing the alcohol based hand-rub practices as per five moments given by WHO amongst the professional health care workers by a single observer.Non participant observation technique was used over 10 days for one and half hour collecting unbiased 50 random samples from accessible population in ICU units of this tertiary care hospital.

Research design

A research design is the framework or guide used for the planning, implementation and analysis of a study and used to collect relevant data pertaining to the study so as to accomplish the objectives of research. The research design used in this study is descriptive cross - sectional.

An observational checklist based on WHO five moments of hand hygiene in health care services related to alcohol based hand-rub 2009 was used among 50 professional health care workers using non participant random sampling by a single observer from 0900- 1030 hrs during morning hours over 10 days in Mar 2020 in ICU. The five moments were before touching the patient, after touching the patient, before performing aseptic and clean procedures, after being at risk of exposure to body fluids and after touching patient surroundings. The alcohol based hand-rub used was Sterilium. Five moments were considered as opportunities and each moment was given a score of 01.Compliance was taken as adherence to these moments. Missed opportunities were also recorded in terms of not following the adherence to these moments. The compliance rate of hand-rub among all HCWs and specific to each moment was assessed.

Setting of study

Intensive care unit comprising of medical, surgical, step down and cardiac care units was the setting of this study. The reasons for this selection are as follows:-

- This area is a part of ICU update curriculum.
- In this area, the health care professionals are expected to take strict compliance towards 5 moments of hand rub practice as per WHO in order to prevent and control nosocomial infections in ICU.

Identification of target and accessible population

Registered professional health care workers available during the duration of conducting research were identified as target population as per inclusion criteria.

Sampling and sampling technique

Sampling is a process of selecting a part of the assigned population to represent the entire population. Non participant observation technique was used. 50 Subjects were selected randomly for the present study without knowledge of the participants in order to obtain an unbiased study. Registered professional health care workers were selected as the sample because professional health care workers by virtue of their knowledge and experience were assumed to have better compliance to hand-rub practices during morning hours when the staff availability is more.

Sample size

A sample size of 50 was considered after inclusion and exclusion criteria.

Inclusion criteria

Registered professional health care workers were included who were available at the time of study in ICU. It comprised of doctors, nurses and paramedics (ORAs).

Exclusion criteria

Nursing cadets, nursing assistants who all are undergoing training. Allied class IV health care workers having less knowledge and awareness of hand-rub practices and other professional health care workers who were not available at that time.

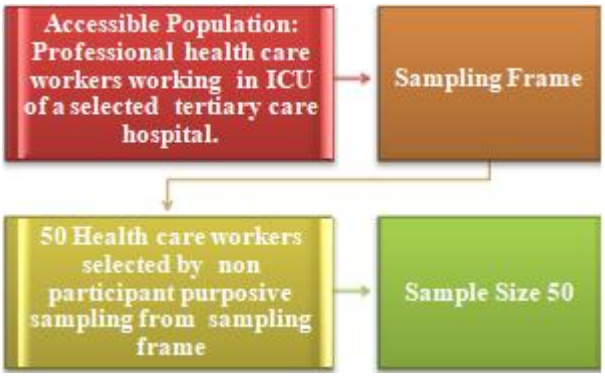

Figure 1: Selection of study sample

Variables

A variable is a measurable or potentially measurable component of an object or event that may fluctuate in quantity or quality. In this study the independent and dependent variables are identified as per the cause effects relationship in the study.

Independent variable

An independent variable is a stimulus or activity that is manipulated or varied by the researcher to create the effect on the dependent variable.

The independent variable used is use of hand-rub.

Dependent variable

The dependent variable is the outcome or response due to the effect of the independent variable, which a researcher wants to predict or explain. Compliance of hand-rub over hand hygiene practices in ICU is a dependent variable.

Tool preparation

Collection of appropriate data based on available information is very essential for the research. An observational checklist was obtained based on guidelines recommended by WHO to assess the hand hygiene practices of professional health care workers using alcohol based hand rub in relation to five moments of hand hygiene. The observational checklist was used by single observer in relation to five moments of WHO when HCWs were indulged in providing patient care to patients in ICU during morning hours.

Description of tool

A checklist used given by WHO on five moments of hand hygiene in health care services, 2009 to assess hand hygiene of professional health care workers using alcohol based hand rub. The tool contains following sections –

Section I: Demographic Data

The section consists of the important details of the sample based on age, professional qualification and years of service experience.

Section II: Checklist

This section consists of the alcohol based hand-rub practices as a hand hygiene measure during the following opportunities:

The checklist has got 5 points, one for each of the following steps.

- Before patient contact

- Before aseptic task
- After body fluid exposure risk
- After patient contact
- After contact with patient surroundings

Each moment was considered as an opportunity.

Compliance rate has been calculated as per scoring points in adherence to moments out of total opportunities observed.

Feasibility of the study

Feasibility of the study was determined by assessing the availability of adequate alcohol based hand-rubs as per WHO formulation, availability of the health care professionals during the morning time of data collection, identifying the place for conducting the study and considering the ethical clearance and providing the necessary privacy for observer and for the group of professional health care workers under study.

Pilot study

Pilot study was carried out at the planning phase of the research in order to explore and test the research elements to make relevant modifications in research sample and methodology. The pilot study for the particular research was conducted on 02nd March 2020 in actual set up on 5 random samples. The ethical clearance was considered.

The result of pilot study was considered and necessary rectification was made. The points noted during pilot study were as follows-

- Availability of sufficient alcohol based hand rubs as recommended by WHO.
- Easy availability of adequate professional health care workers during morning hours.
- Unbiased 10 days data collection by a single observer for one and half hr daily in ICU units
- Random sampling and non participant observation to be used using observational checklist recommended by WHO in use of alcohol based hand-rub as a hand hygiene practice among professional health care workers in relation to five moments during data collection.
- Privacy to researcher collecting data and confidentiality of professional health care workers to be maintained.
- The changes were done in the actual research to get unbiased study.

Data collection procedure

Formal Permission was obtained from head of this tertiary care hospital in addition to ethical committee clearance. Data was collected from 07 Mar 20-17 Mar 20 by a single observer over 10 days duration using non participant observation technique. Random sampling was done from the group of professional health care workers available in ICU during 0900 hrs to 1030 hrs. Pilot study was done 0n 02 Mar 20. Sterilium availability and reinforcement of hand hygiene measures done by displaying of WHO Posters for hand rub in ICU in all units –medical surgical, step-down and cardiac care units by hospital administration so as to maintain awareness of hand hygiene practices among health care workers. Samples were taken on random basis from doctors, nurses and paramedics (ORAs).Total 50 health care workers were taken. Confidentiality of samples was maintained. Informed consent was avoided as it could lead to biased behaviour by professional health care workers in relation to use of Sterilium, an alcohol based hand-rub while following hand hygiene practices. Observational checklist used was used – "The Five moments of hand hygiene in health care services, 2009"given by WHO. Demographic data of samples in respect to age, professional qualification and years of experience was also collected. Five moments were considered as opportunities and each moment was given score of 01.Compliance was taken as adherence to these moments. Missed opportunities was also recorded in terms of not following the adherence to these moments.

Plan for data analysis

Data analysis was planned to perform using descriptive quantitative statistics.

Figure 2: Schematic representation of the research process

6. Data Analysis and Interpretation

This chapter deals with analysis and interpretation of data collected from professional health care workers working at tertiary care hospital, who were observed during patient care without their knowledge. The purpose of analysis was to describe the data in the meaningful terms and reduce the data to an intelligibly and interpretable form so that the relation of the research problem can be studied and assumptions can be verified.

Analysis and interpretation of the data was based on the following objective of the study

1) To assess the hand rub practices followed by health care workers in ICU in adherence to five moments of hand hygiene practices given by WHO.

Data analysis included descriptive statistics. The findings of the study were organised and presented in following section-

***Section 1*:** Sample characteristics.
Section 2: Analysis of opportunities observed in HCWs as per WHO five moments of hand-rub in ICU.
Section 3: Analysis of adherence of HCWs to opportunities as per WHO five moments of hand-rub in ICU.
Section 4: Analysis of missed opportunities among HCWs in relation to WHO five moments of hand-rub.
Section 5: Analysis of opportunities, adherence and missed opportunities among HCWs in ICU as per WHO five moments of hand-rub
Section 6: Overall compliance of alcohol based hand-rub practices among HCWs in ICU as per WHO five moments.
Section 7: Analysis of compliance of hand-rub among HCWs specific to each moment.

Section 1

Demographic data containing sample characteristics

Table 1: Frequency and percentage distribution of socio-demographic variables of health care workers in tertiary care hospital, n=50

Parameters	Category	Frequency	Percentage (%)
Age	<20 Yrs	0	0 %
	21-29 Yrs	17	34 %
	30-39 Yrs	21	42 %
	>40 Yrs	12	24 %
Professional Qualification of HCWs	Diploma	19	38 %
	Graduate	12	24 %
	Post-Graduate	19	38 %
Professional Category of HCWs	Doctors	17	34 %
	Nurses	30	60 %
	Paramedical Staff	3	6 %
Service Experience Of HCWs	1-5 Yr	14	28 %
	6-10 Yr	17	34 %
	11-15 Yr	6	12 %
	16-20 Yr	5	10 %
	21-25 Yr	6	12 %
	26-30 Yr	2	4 %

Section 1

Sample characteristics

Age, professional qualification, category of professional HCWs and their service experience was collected in demographic data collection of HCWs. Professional health care workers from doctors, nurses and paramedics (ORAs) were taken on random basis from the HCWs available during morning hours in ICU subunits. These professional health care workers are registered under statutory bodies of respective councils and they are assumed to be acquainted with WHO alcohol based hand-rub practices through displayed WHO Posters of hand-rub practices in all units of ICU in relation to five moments and also by virtue of their professional qualification and years of experience in health care services.

Table 1 shows that with regard to age, 42% (21) of HCWs were in age group of 30-39 yrs, 34% (17) were in age group of 21-29 yrs and 24% (12) were in age group of > 40 yrs and no HCW was in age group of < 20 yrs.

Data also reveals that 100 % subjects of professional HCWs were qualified as professionals and registered under statutory bodies. With regard to Professional qualification 38% (19) had diploma degree.Another 38% (19) had postgraduate degrees and rest 24% (12) of health care workers working in ICU were graduates in their respective fields of profession and therefore were aware of hand-rub practices.

It also shows that 60% (30) of professional HCWs were nurses, 34% (17) were doctors and 6 % (3) were paramedics (ORAs). Therefore, majority of workforce working in ICU was of nurses. In terms of years of experience, 34% (17) were in group of 6-10 yrs, 28% (14) were in group of 1-5 yrs.12% (6) and 10 % (5)were having professional experience of 11-15 yrs and 16-20 yrs respectively Majority had service experience of 6-10 yrs followed by 1-5 yrs of service.

Analysis of data shows, 60 % (30) of professional HCWs were nurses, 34% (17) were doctors and 6 % (3) were paramedics (ORAs). Majority of HCWs were in age group of 30-39 yrs. They had diploma and postgraduate degrees. Thus, the workforce in ICU was of well qualified, of moderate age group and majority having > 1 yr of service experience in providing health care services.

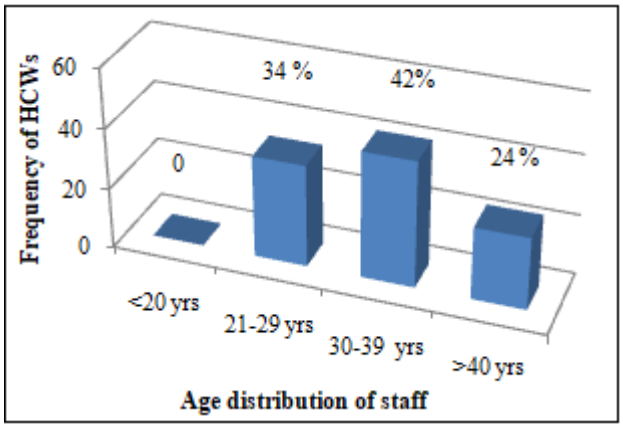

Figure 3: Bar diagram showing age wise distribution of Health Care workers of ICU in a tertiary care hospital in percentage

Figure 3 shows that out of 50 subjects, 42% (21) of HCWs were in age group of 30-39 yrs, 34% (17) were in age group

of 21-29 yrs and 24% (12) were in age group of > 40 yrs and no HCW was in age group of < 20 yrs.

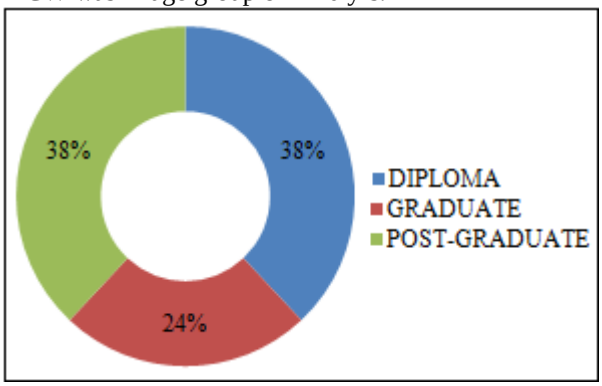

Figure 4: Pie diagram showing professional qualification of Health Care workers of ICU in a tertiary care hospital

Figure 4 reveals that 100 % subjects of professional HCWs were qualified as professional HCWs. With regard to Professional qualification 38% (19) had diploma degree.Another 38% (19) had postgraduate degrees and rest 24% (12) of health care workers working in ICU were graduates in their respective fields of profession and therefore aware of hand-rub practices.

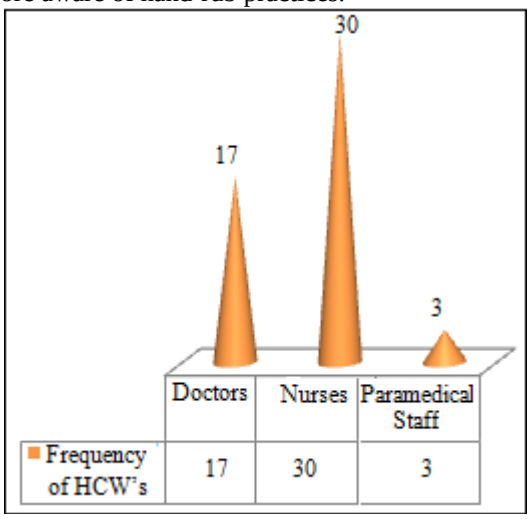

Figure 5: Cone diagram showing distribution of Professional Health Care workers of ICU in a tertiary care hospital

Figure 5 shows that 60% (30) of professional HCWs were nurses, 34% (17) were doctors and 6% (3) were paramedical staff. Therefore, majority of workforce working in ICU was of nurses.

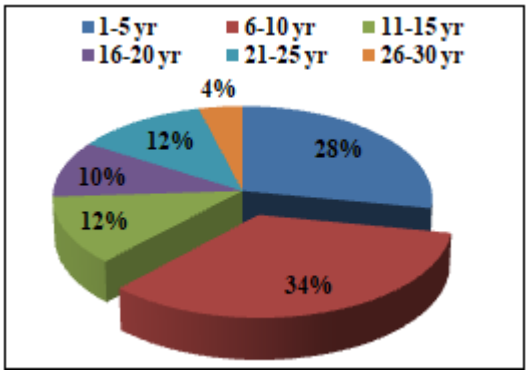

Figure 6: Pie diagram showing distribution of professional years of experience of Health Care workers of ICU in a tertiary care hospital

Table 1 and figure 6 reveals that with respect to professional years of experience, 34% (17) were in group of 6-10 yrs, 28% (14) were in group of 1-5 yrs.12% (6) and 10 % (5)were having professional experience of 11-15 yrs and 16-20 yrs respectively. Majority had service experience of 6-10 yrs followed by 1-5 yrs of service.

Section 2

Analysis of opportunities observed in HCWs as per WHO five moments of hand-rub in ICU.

Table 2: Showing opportunities observed among HCWs in ICU

HCWs	Opportunities observed	Percentage (%)
Doctors (17)	68	30
Nurses (30)	148	64
Paramedics (3)	13	6
Total	229	100

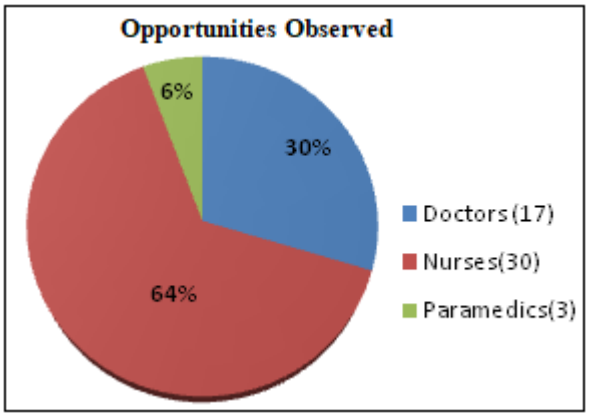

Figure 7: Pie diagram showing percentage of opportunities observed in HCWs of ICU in relation to five moments of hand-rub

Figure 7 depicts that 64% (148), opportunities in relation to hand-rub practices as per five moments of WHO were observed among nurses who were majority of workforce working in ICU followed by 30% (68) who were doctors and 6% (13) were observed among paramedics who had worked in operation theatre.Opportunities were five moments in relation to alcohol based hand-rub practices as given by WHO.

These opportunities observed among HCWs in relation to five moments which were before touching the patient, after touching the patient, before performing aseptic and clean procedures, after being at risk of exposure to body fluids and after touching patient surroundings.

Section 3

Analysis of adherence of HCWs to opportunities as per WHO five moments of hand-rub in ICU

Table 3: Showing adherence of HCWs to opportunities observed as per WHO five moments of hand-rub in ICU

HCWs	Frequency of Adherence	Percentage (%)
Doctors (17)	10	12.20
Nurses (30)	65	79.27

Paramedics (3)	7	8.54
Total	82	100.00

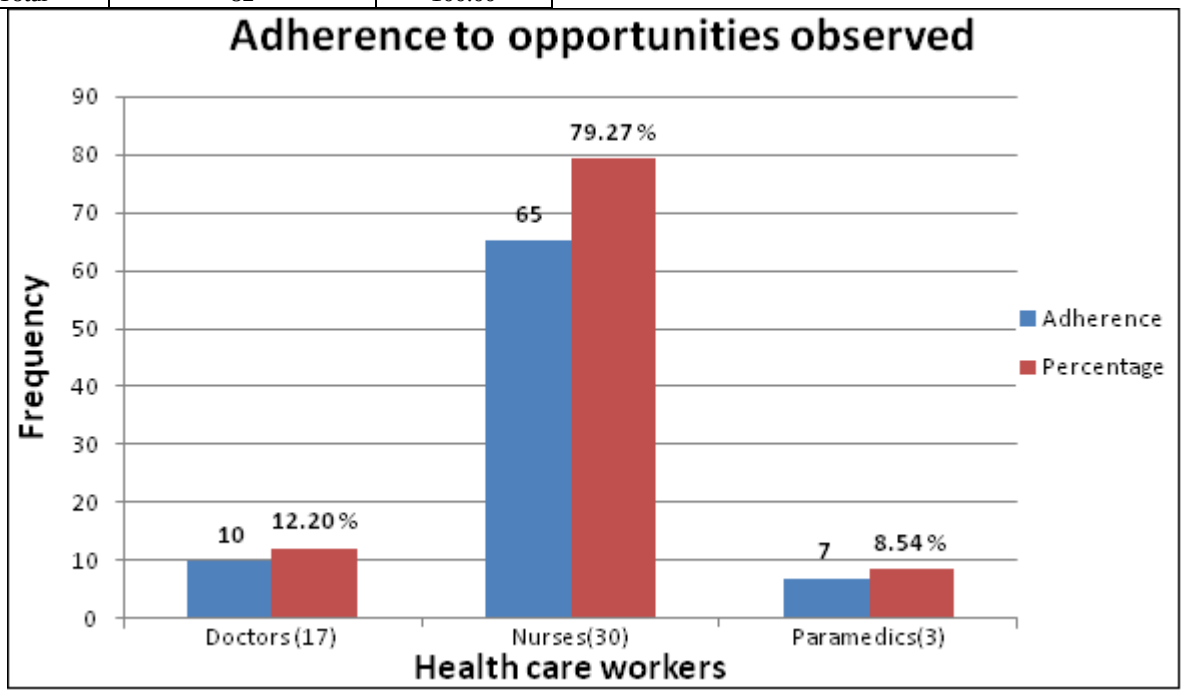

Figure 8: Bar diagram showing adherence to opportunities observed among HCWs in respect to five moments of alcohol based hand-rub practices as per WHO

Figure 8 depicts that adherence practices to opportunities provided were 79.27% (65) among nurses which owes to its large number of 30 nurses in ICU followed by 12.20% (10) among doctors who were 17 in number and least 8.54% (7) among the paramedics (ORAs).

The rise in number of adherence can be explained on basis of more opportunities observed among HCWs and subsequently to the corresponding number of HCWs working in ICU.

Section 4

Analysis of missed opportunities among HCWs in relation to WHO five moments of hand-rub in ICU.

Table 4: Shows missed opportunities of alcohol based hand-rub practices among HCWs in relation to WHO five moments

HCWs	Frequency of Missed opportunities	Percentage (%)
Doctors (17)	58	39.46
Nurses (30)	83	56.46
Paramedics (3)	6	4.08
Total	147	100.00

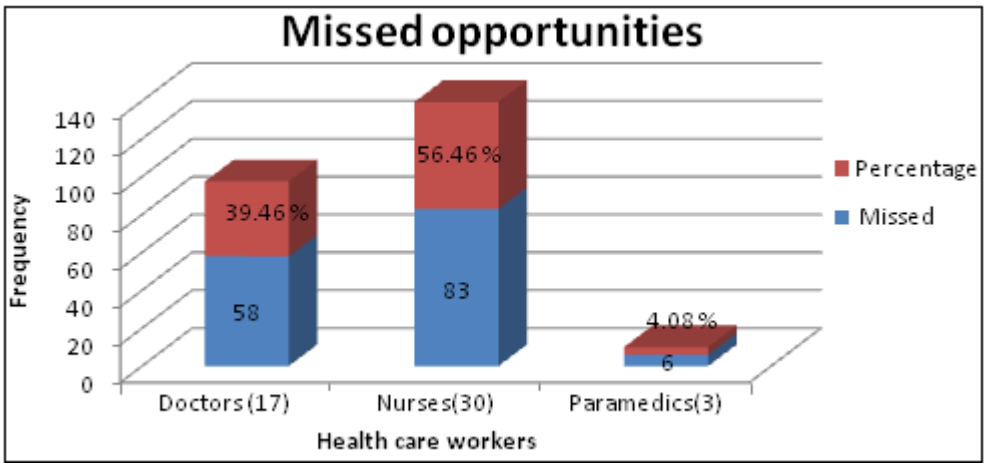

Figure 9: Bar diagram showing distribution of missed opportunities of HCWs in ICU as per WHO five moments of hand-rub

Figure shows, 56.46% (83) was missed opportunities seen in relation to five moments of alcohol based hand-rub among the nurses followed by 39.46% (58) among doctors. Least 4.08 % (6) was among paramedics (ORAs).More missed opportunities were seen in nurses owing to increased workload of critically ill patients over the available nursing staff of ICU. The missed opportunities among doctors may be attributed to neglecting attitudes towards hand hygiene practices. Least number of missed opportunities in ORAs signifies to strict infection control practices being followed by them in Operation theatre in addition to less workload of

patient care. Hand-rub is one of the infection control practices.

Section 5

Analysis of opportunities, adherence and missed opportunities among HCWs in ICU as per WHO five moments of hand-rub.

Table 5: Shows total expected and actual outcome of opportunities, adherence, and missed among HCWs

Outcome	Opportunities	Adherence	Missed
Total Expected	250	229	0
Actual	229	82	147

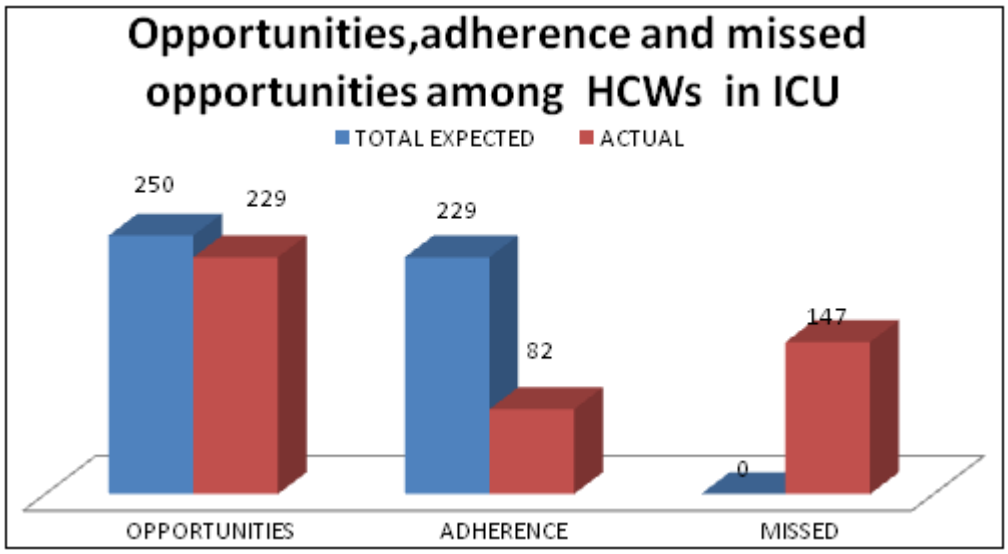

Figure 10: Bar diagram showing opportunities, adherence and missed opportunities among HCWs in relation to five moments of hand rub practices

This figure 10 depicts that actual total opportunities observed in HCWs working in ICU were 229 as compared to total expected number of 250 opportunities. The total numbers of opportunities were less as compared to expected ones depending upon the availability of health care services provided by HCWs as per their profession. The actual adherence practices among HCWs were 82 as compared expected outcome of 229. The actual missed opportunities among HCWs were 147. Ideally, it should have been be zero.

Thus, actual number of opportunities observed and missed opportunities are more as compared to adherence practices among HCWs in relation to five moments of alcohol based hand-rub practices as per WHO.

Section 6

Overall compliance of alcohol based hand-rub practices among HCWs in ICU as per WHO five moments

Table 6: Overall compliance of alcohol based hand-rub practices among HCWs in ICU as per WHO five moments

Professional Category	Opportunities	Adherence	Compliance (%)
Doctors	68	10	15 %
Nurses	148	65	44 %
Paramedics	13	7	54 %
TOTAL	229	82	

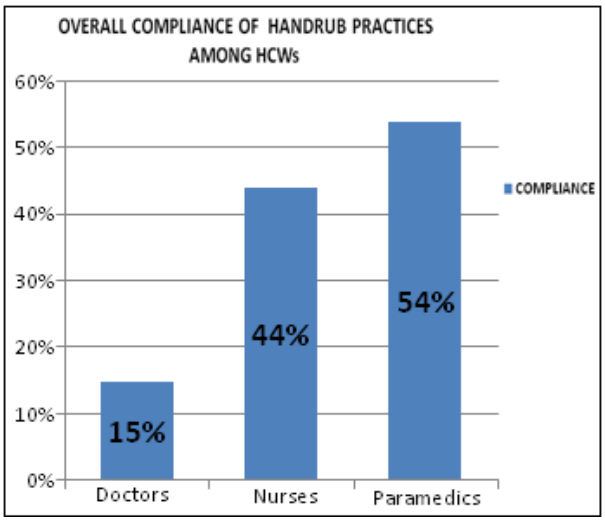

Figure 11: Bar diagram showing overall compliance alcohol based hand-rub practices among HCWs in relation to five moments of WHO

Figure 11 reveals that 54% compliance of alcohol based hand-rub practices was observed among paramedics who were ORAs over 44% practices seen among nurses. The least 15% compliance was seen in doctors.

Section 6

Analysis of compliance of alcohol based hand-rub practices specific to each moment.

Table 7: Showing compliance of alcohol based hand-rub practices specific to each moment.

Moments (Opportunity)	Opportunities observed	Adherence	Compliance (%)
Before patient contact	50	5	10
Before clean and aseptic procedures	36	31	86
After patient contact	50	29	58
After contact with body fluids	43	12	27.9
After touching patients surrounding	50	5	10

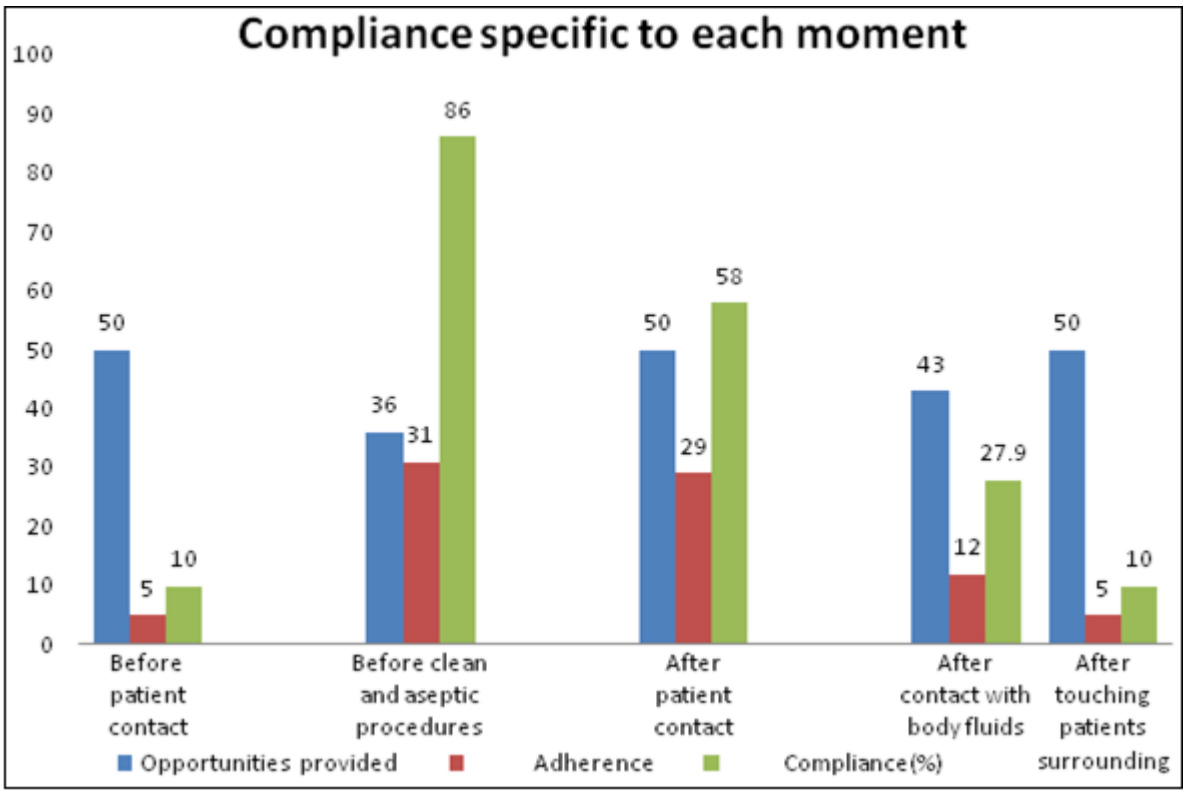

Figure 12: Compliance of alcohol based hand-rub practices specific to each moment of hand-rub

Figure 12 depicts, More compliance (86%) was observed in the specific moment of hand-rub i.e. before clean and aseptic procedure followed by 58% compliance in the moment of after patient contact among HCWs.

After contact with body fluids, compliance observed was 27.9 % among HCWs. The least compliance of 10% was seen in two moments out of five i.e. before patient contact and after touching patients surrounding.

Section 7
Analysis of compliance of hand-rub among HCWs specific to each moment

Table 8: Compliance of hand-rub among HCWs specific to each moment

Moments	Doctors (17)		Nurses (30)		Paramedics (3)	
	Opportunities Observed / Adherence	Compliance (%)	Opportunities observed / Adherence	Compliance (%)	Opportunities observed / Adherence	Compliance (%)
Before patient contact	17 / 0	0	30 / 3	10	3 / 2	66.7
Before clean and aseptic procedure	06 / 06	100	29 / 24	82.7	1 / 1	100
After patient contact	17 / 0	0	29 / 25	86.2	3 / 3	100
After contact with body fluids	11 / 3	27	30 / 9	30	3 / 1	33.3
After touching patient Surrounding	17 / 01	5.9	30 / 4	13	3 / 0	0

Table 8 shows, 100% compliance rate was observed among doctors and paramedics (ORA) and 82.7 % among nurses in relation to moment before clean and aseptic procedures.

100 % compliance was seen in paramedics (ORAs) in the moment of after patient contact whereas 86.2% was seen among nurses and negligible among doctors. The compliance rate < 40% was seen in moments specific to after contact with body fluids among all HCWs.

The least compliance rate of < 15% was observed among doctors and nurses after touching patient surrounding and almost negligible among paramedics.

7. Discussion

The study was conducted to assess the compliance of use of hand rub as a hand hygiene practice among health care workers in ICU of a tertiary care hospital in Lucknow.

Increased nosocomial infections occur in ICU set up of hospitals due to improper hand hygiene practices. Nosocomial infections increase the hospital stay, mortality rates and financial burden to the organisation. There is a frequent contact between hospitalised patients and health care workers in terms of carrying out diagnostic procedures, providing therapeutic care and direct patient care in ICU set up.

According to CDC 2015, On any given day, about one in 31 hospital patients has at least one healthcare-associated infection. Patients in the 2015 HAI Hospital Prevalence survey were at least 16% less likely than patients in the 2011 survey to have an HAI. 3% of hospitalized patients in the 2015 survey had one or more HAI.

According to WHO 2010, Hundreds of millions of patients are affected by health care-associated infections worldwide each year, leading to significant mortality and financial losses for health systems. Of every 100 hospitalized patients at any given time, 7 in developed and 10 in developing countries will acquire at least one health care-associated infection. The endemic burden of health care-associated infection is also significantly higher in low and middle income than in high income countries, in particular in patients admitted to intensive care units.

Hand hygiene is regarded as one of the most important element of infection control. In today's world of growing burden of health care associated infections and other severe viral outbreak e.g. COVID-19 outbreak, the increasing severity of illness and complexity of treatment, multi drug resistant infections, hand hygiene practices have become mandatory for everyone. Hand hygiene practices can be done either by following correct handwashing techniques or by following correct technique of alcohol based hand-rub practices.

Alcoholic based hand rub practices among HCWs in ICU set up are the most effective, easily available, less time consuming and infact faraway from the problems of infrastructural facilities for handwashing in ICU. These hand-rub practices are equivalent to handwashing until and unless hands are visibly soiled but correct technique of hand rubbing should be practiced by all HCWs so as to prevent nosocomial infections as well as occupational infections.Nowadays because of Covid-19 outbreak again alcohol based hand-rub practices have gained momentum in its use.In ICU setup where the workload of critically ill patients is more over available HCWs. In addition to this, many lifesaving procedures keep on taking place because of critical condition of patients. Many a times HCWs nurses are not able to follow hand-rub practices because of increased workload.

An observational checklist in relation to five moments of hand hygiene practices given by WHO was used to assess the hand hygiene practice of professional health care workers using alcohol based hand rub.Sterilium was used as an alcohol based hand-rub. Non participant observation technique was used in random sampling of HCWs in ICU.50 HCWs were selected on random basis so as get unbiased study. Formal Permission was obtained from head of this tertiary care hospital in addition to ethical committee clearance. Data was collected from 07 Mar 20-17 Mar 20 by a single observer over 10 days duration using non participant observation technique using inclusion and exclusion criteria. In this study, total 229 opportunities were observed among the HCWs, out of which the total adherence to opportunities was 82 and missed opportunities was 147 among them.

The maximum overall hand-rub compliance rate of alcohol based hand-rub as per WHO five moments was 54% among paramedics (ORAs) who were diploma holders and working in OT for a longer period of time followed by compliance rate of 44% among nurses and least of 15% was observed among doctors. However, maximum nurses were diploma holders and graduates. A large number of doctors were postgraduates. Thus, knowledge is important for hand-rub practices but more important is to emphasise on strict adherence to these alcohol based hand-rub practices as per five moments given by WHO.Increased workload over nurses in ICU many a times becomes a barrier in adherence to hand-rub practices.

In relation to specific moments of alcohol based hand-rub practices given by WHO, 100% compliance rate was observed among doctors and paramedics (ORAs) and 82.7% among nurses in relation to moment "before clean and aseptic procedures".

100% compliance was seen in paramedics (ORAs) in the moment of 'after patient contact' whereas 86.2% was seen among nurses and negligible among doctors. The compliance rate < 40 % was seen in moments specific to "after contact with body fluids" among all HCWs.

The least compliance rate of < 15% was observed among doctors and nurses in the moment "after touching patients surrounding" and almost negligible among paramedics.

The maximum overall hand-rub compliance of 54% among paramedics (ORAs) is attributed to strict infection control practices being followed by them in Operation theatre and hand-rub is one of the infection control practices to which they adhere to in all the procedures of OT. Secondly, the paramedics (ORAs) are more indulged in maintenance of the ventilators and other equipments and are less involved in patient care activities. Sometimes, they get indulged in patient care activities related to invasive procedures like central line insertion, intubation etc. Reinforcement on maintaining strict aseptic techniques in OT has helped them in attaining the highest compliance rate whereas 44% compliance was observed among nurses as they had increased workload of patient care as compared to other HCWs. In this study, increased workload interfered with hand-rub practices among nurses, howsoever strong knowledge and professional experience they had. Least overall hand-rub compliance of 14% among doctors can be attributed to least importance given by them towards alcohol based hand-rub practices.

This present study was supported in relevance to decreased hand-rub compliance among nurses due to increased workload by a cross-sectional study conducted by Sharma S, Sharma S, Puri S, Whig J on Hand hygiene compliance in

the intensive care units of a tertiary care hospital in 2011 among 114 HCWs using a questionnaire and an observational tool revealed that the overall compliance was 43.2% (394/911 opportunities). It was 68.9% (31/45) in the intensivists, 56.3% (18/32) in attending physicians, 40.0% (28/70) in the postgraduate residents and 41.3% (301/728) in the nurses. Compliance of the study group is affected by the activity index (number of opportunities they come across per hour) and professional status. The HCWs listed less knowledge, lack of motivation, increased workload as some of the factors influencing HH.

The present study in relation to WHO five moments of alcohol based hand-rub practices was compared with a cross-sectional study conducted by Kenneth I. Onyedibe, Nathan Y. Shehu, Daniela Pires, Samson E. Isa, Mark O Okolo, Simji S. Gomerep on Assessment of hand hygiene facilities and staff compliance in a large tertiary health care facility in northern Nigeria: a cross sectional study among 175 HCWs in 46 clinical units including ICU of the hospital compliance was 21% before patient contact, 23% before aseptic procedure, 63% after body fluid exposure risk, 41% after patient contact and 40% after contact with patients' surrounding. The present study was supported by the compliance rate 41 % was seen in moments specific to" after contact with body fluids" among all HCWs whereby in other moments it differed.

This present study was contradicted by the descriptive study done by Rejani R on hand hygiene among health care workers in a tertiary care hospital in 2017 using a questionnaire and an observation tool among 30 HCWs revealed that 50% of subjects used soap and water alone for hand hygiene, 53.33% of subjects used alcohol based hand-rub. Nurses showed more overall hand hygiene compliance of 90.8% followed by 83.78% among paramedical nursing staff and least 74.6% among doctors.

Sample characteristics
In this study, all HCWs 50 selected on random basis were professional and registered under their respective councils. Most of the HCWs, 37 % belonged to age group of 30-39 yrs and the majority of HCWs, 60 % were nurses and maximum, 34 % subjects had 1-5 yrs of experience. As per professional qualification, 38% were postgraduates, 38% had diploma degree and 24% of subjects were graduates in their respective field of profession.

A prospective descriptive study conducted by Rejani R on hand hygiene among health care workers in a tertiary care hospital in 2017 using a questionnaire and an observation tool among 30 HCWs revealed that 53.33% of subjects used alcohol based hand-rub. Most of the HCWs, 37 % belonged to age group of 20-29 yrs and the majority of HCWs, 57 % were nurses and maximum, 40 % subjects had 1-5 yrs of experience.

Analysis of opportunities observed in HCWs as per WHO five moments of hand-rub in ICU.
64% (148), opportunities in relation to hand-rub practices as per five moments of WHO were observed among nurses who were majority of workforce working in ICU followed by 30% (68) who were doctors and 6% (13) were observed in paramedics (ORAs). These opportunities observed among HCWs in relation to five moments which were before touching the patient, after touching the patient, before performing aseptic and clean procedures, after being at risk of exposure to body fluids and after touching patient surroundings. More opportunities were observed in nurses as compared to doctors and paramedics which signifies increased workload of patient care in ICU being done by them.

Analysis of adherence to opportunities observed among HCWs as per WHO five moments of hand-rub in ICU.
Adherence practices to opportunities observed were 79.27% (65) among nurses which owes to its large number of 30 nurses in ICU followed by 12.20% (10) among doctors who were 17 in number and least 8.54% (7) among the paramedics (ORAs). Thus, there has been rise in opportunities observed and its adherence practices of alcohol based hand-rub practices as per five moments of WHO. The rise in number of adherence can be explained on basis of more opportunities observed among HCWs and subsequently to the corresponding number of HCWs working in ICU.

Analysis of missed opportunities of HCWs as per WHO five moments of hand-rub in ICU.
56.46% (83) were missed opportunities seen in relation to five moments of alcohol based hand-rub among the nurses followed by 39.46% (58) among doctors. Least 4.08 % (6) was among paramedics (ORAs).More missed opportunities were seen in nurses as they have increased workload of critically ill patients as compared to others in ICU. Least number of missed opportunities were seen in ORAs signifies to strict infection control practices being followed by them in Operation theatre apart from decreased workload of patient care in ICU.Hand-rub is one of the infection control practices.

Analysis of opportunities, adherence and missed opportunities among HCWs in ICU as per WHO five moments of hand-rub
Actual total opportunities observed in HCWs working in ICU were 229 as compared to total expected number of 250 opportunities. The total number of opportunities was less as compared to expected ones depending upon the availability of health care services provided by HCWs as per their profession. The actual adherence practices among HCWs were 82 as compared expected outcome of 229. The actual missed opportunities among HCWs were 147. Ideally, it should have been be zero.

Thus, actual number of opportunities observed and missed opportunities is more as compared to adherence practices among HCWs in relation to five moments of alcohol based hand-rub practices as per WHO.

Compliance of health care workers in relation to five moments of hand-rub
54% compliance of alcohol based hand-rub practices was observed among paramedics who were ORAs over 44% practices seen among nurses. The least 15 % compliance was seen in doctors

Analysis of compliance of alcohol based hand-rub practices among HCWs specific to each moment of hand-rub practice.

In this study, more compliance (86%) was observed in the specific moment of hand-rub i.e before clean and aseptic procedure followed by 58 % compliance in the moment of after patient contact among HCWs.

"After contact with body fluids" compliance observed was 27.9 % among HCWs. The least compliance of 10 % was seen in two moments out of five i.e "before patient contact "and "after touching patient surroundings".

The present study in relation to WHO five moments of alcohol based hand-rub practices was compared with a cross-sectional study conducted by Kenneth I. Onyedibe, Nathan Y. Shehu, Daniela Pires, Samson E. Isa, Mark O Okolo et al on Assessment of hand hygiene facilities and staff compliance in a large tertiary health care facility in northern Nigeria: a cross sectional study among 175 HCWs in 46 clinical units including ICU of the hospital compliance was 21% before patient contact, 23% before aseptic procedure, 63% after body fluid exposure risk, 41% after patient contact and 40% after contact with patients surrounding. The present study was supported by the compliance rate 41 % was seen in moments specific to" after contact with body fluids" among all HCWs whereby in other moments it differed.

These findings were supported by the findings of the study conducted by Venkata on Hand hygiene monitoring using the 5 moments of hand hygiene in 2015 among 283 HCWs using an observational tool reveals that compliance on all 5 moments of hand hygiene was 56% while 44% did not adhere to moments one, four and five, "Before touching a patient (13.2%), after touching a patient (12.8%), and after touching a patients surroundings (11.8%)" respectively.

A cross-sectional study conducted by Shehu on assessment of hand hygiene facilities and staff compliance in a large tertiary health care facility in 2010 among 175 HCWs using an observational tool shows that based on WHO "5 moments" for hand hygiene average compliance was 21% before patient contact, 23% before aseptic procedure, 63% after body fluid exposure risk, 41% after patient contact, and 40% after patients contact with surrounding. This study supported our study in one moment that is before patient contact as the percentage found in both the studies was the least one i.e. 10% in our study.

Analysis of compliance of hand-rub among HCWs specific to each moment

In this present study, 100% compliance rate was observed among doctors and paramedics (ORAs) and 82.7 % among nurses in relation to moment "before clean and aseptic procedures". The compliance rate < 40 % was seen in moments specific to "after contact with body fluids" among all HCWs including nurses.

The least compliance rate of < 15% was observed among doctors and nurses "after touching patients surroundings" and almost negligible among paramedics.

This study was supported by findings of a cross-sectional analytical study conducted by Luccas on adherence to the five moments of hand hygiene among intensive care professionals in 2012 among 125 HCWs reveals that the adherence rate was 43.7%. The greatest adherence to hand hygiene was by physiotherapist (53.5%) and lowest adherence was among the doctors (29.2%). Indications to lowest adherence rate were "before touching the patient" (18.4%) and "before aseptic procedure" (20.9%).

Assumptions testing

In this study, All professional health care workers were assumed to have awareness regarding 5 moments of hand rub as per WHO. Professional health care workers by virtue of their knowledge, training and experience were assumed to have better compliance to hand rub practices. All professional health care workers are assumed to be well acquainted with hand rub practices in intensive care units of this selected tertiary care hospital creating awareness about hand rub practices among HCWs through display of posters on hand-rubs as per WHO five moments of hand-rub and pressing reminder bells frequently in ICU for use of hand-rubs.

The maximum overall hand-rub compliance rate of alcohol based hand-rub as per WHO five moments was 54% among paramedics (ORAs) who were diploma holders and working in OT for a longer period of time followed by compliance rate of 44% among nurses and least of 15% was observed among doctors. However, maximum nurses were diploma holders and graduates. A large number of doctors were postgraduates. Thus, knowledge is important for hand-rub practices but more important is to emphasise on strict adherence to these alcohol based hand-rub practices as per five moments given by WHO.Increased workload over nurses in ICU many a times became a barrier in adherence to hand-rub practices.

The maximum overall hand-rub compliance of 54% among paramedics (ORAs) is attributed to strict infection control practices being followed by them in Operation theatre and hand-rub is one of the infection control practices to which they adhere to in all the procedures of OT. Secondly, the paramedics (ORAs) are more indulged in maintenance of the ventilators and other equipments and are less involved in patient care activities. Sometimes, they get indulged in patient care activities related to invasive procedures like central line insertion, intubation etc. Reinforcement on maintaining strict aseptic techniques in OT has helped them in attaining the highest compliance rate whereas 44% compliance was observed among nurses as they increased workload of patient care as compared to other HCWs. In this study, increased workload interfered with hand-rub practices among nurses, howsoever strong knowledge and professional experience they had. Least overall hand-rub compliance of 14 % among doctors can be attributed to least importance given by then towards alcohol based hand-rub practices.

8. Summary and Recommendation

This chapter presents summary of the study and includes the implication and recommendations for future research in this field.

Summary

The objective of the study was to assess the compliance of use of hand rub as a hand hygiene practice among health care workers in ICU of a tertiary care hospital in Lucknow.

To assess the hand rub practices followed by health care workers in ICU in adherence to five moments of hand hygiene practices given by WHO.

Review of literature

The review of literature has been divided under the following sections:

- Compliance of hand rub among health workers
- Use of hand rub as a hand hygiene
- Hand rub used in critical care units
- Use of five moments of hand hygiene as per WHO

Major findings of the study

In this study, all HCWs 50 selected on random basis were professional and registered under their respective councils. Most of the HCWs, 37 % belonged to age group of 30-39 yrs and the majority of HCWs, 60% were nurses and maximum, 34 % subjects had 1-5 yrs of experience. As per professional qualification, 38% were postgraduates, 38% had diploma degree and 24% of subjects were graduates in their respective field of profession. The maximum overall compliance rate in relation to five moments was 54% among paramedics 44 % among who were operating room attendants, diploma holders and working in OT for a longer period of time followed by compliance rate of 44% among nurses who and least were observed 15% among doctors. However, maximum nurses were diploma holders and graduates.

A large number of doctors were postgraduates.

More compliance (86%) was observed in the specific moment of hand-rub i.e before clean and aseptic procedure followed by 58 % compliance in the moment of after patient contact among all HCWs.

After body contact, compliance observed was 27.9 % among HCWs. The least compliance of 10 % was seen in two moments out of five i.e. before patient contact and after touching patient surroundings. Thus, knowledge is important for hand-rub practices but more important is to emphasise on strict adherence practices to this alcohol based hand-rubs as per five moments given by WHO.In our study increased workload over nurses in ICU many a times became a barrier in adherence to hand-rub practices.

The result of improved overall compliance of hand-rub in paramedics over nurses and doctors may be attributed to decreased workload of patient care over them in addition to strict aseptic techniques being followed by then in operation theatre. Awareness, Knowledge, years of experience and infection control skills of HCWs will be affected if workload of patient care is being overlooked.

9. Implication

The findings of the study have implication in the field of health administration, nursing practices, nursing education and Hospital Infection Control Committee.

Implications for health administration

- Availability of adequate hand rubs in patient care unit is to be done for improving hand rub practices.
- Regular reinforcement through structured teaching programme on" five moments of hand hygiene in health care services" as per WHO in prevention of nosocomial infections to be carried out.
- Institutional motivation for hand rubs practices by health care worker to be evolved. It may be in the any form of reward either verbal or written.
- Self evaluation by HCWs themselves to be done to increase alcohol based hand-rub practices.
- Frequent return demonstration by HCWs on 'five moments of hand-rub 'as per WHO to be organized in patient care units of hospital set up to increase its practices.
- Orientation programme to newly inducted staff should incorporate hand hygiene practices on alcohol based hand-rubs in addition to handwashing.

Implications for nursing practice

- Frequent use of alcohol based hand-rub practices as per five moments of WHO will not only prevent nosocomial infections but also occupational infections to HCWs working in ICU of hospital as contaminated hands harbour many invisible pathogens. So, its use should be encouraged.
- Structured teaching programmes to be carried out in ICU on awareness regarding occupational infections, nosocomial infections and role of alcohol based hand rub practices in its prevention among nurses and other HCWs working there.
- The nursing heads in each unit of ICU must act as Infection control nurse and emphasise on hand hygiene practices including alcohol based hand-rub as it is easily available and easy to follow.
- The workload of nursing staff must be considered in order to maintain the best handhygiene practices in critical care units.

Implication for nursing education

- In service education on hand hygiene practices as a part of infection control measures can be conducted to strengthen the alcohol based hand-rubs practices.
- Development of checklist and supervision of hand hygiene practices including alcohol based hand-rubs among nursing students and paramedical nursing staff to be done by educators in nursing arts lab as well as in clinical set ups.

Implications for nursing research

- Research studies can be included to depict the severe morbidity and mortality rates due to non compliance of hand hygiene.
- Evidence based practices to be implied in clinical setting for compliance of hand hygiene practices including alcohol based hand-rubs.
- Research to be conducted on effectiveness of alcohol based hand-rub practices in prevention of nosocomial infections and also occupational infections.
- Research might be conducted on easy availability of alcohol based hand-rubs in improving handhygiene compliance among HCWs.

Implications for Hospital Infection Control Committee

- The findings of this research could be used in conducting further research so as to assess the compliance of alcohol based hand hygiene practices among HCWs over a longer period of time.
- Research on assessment of effectiveness of alcohol based hand-rubs in prevention of nosocomial infections can be done.
- Research on easy availability of alcohol based hand-rubs in improving hand hygiene compliance rate among HCWs in clinical care units of hospital can be done.

Recommendation

On the basis of findings recommendations are drawn for future research –

- A study can be conducted using audio-video assisted programme on promotion of hand hygiene practices.
- A regular reinforcement structured teaching programme on hand hygiene practices including alcohol based hand-rubs to be carried out.
- A study can be conducted to assess the knowledge, practices and attitude of health care workers on hand hygiene as per 5 moments of WHO.

10. Conclusion

In health care system, hand hygiene practices including alcohol based hand-rubs are useful not only from the perspective of prevention of nosocomial infections but also in prevention of occupational infections.

Alcohol based hand hygiene practices following 5 moments of hand-rub as per WHO in providing health care services is the best way to prevent infections.

In this present study, the result of improved overall compliance of hand-rub in paramedics over nurses and doctors may be attributed to decreased workload of patient care over them in addition to strict aseptic techniques being followed by then in operation theatre. Awareness, Knowledge, years of experience and infection control skills of HCWs will be affected if workload of patient care is being overlooked.

References

[1] World Health Organization.Patient safety.Save lives.Clean your Hands.Health care associated infections.Fact sheeet.2010 Apr 30[cited 2020 Feb 27]World Health Organisation. Safety checklist WHO 5 moments of hand hygiene. https://www.who.int/infection-prevention/campaigns/clean-hands/5moments/en.

[2] Centers for disease control and prevention.CDC 24/7:Saving Lives, protecting people.HAI hospital prevalence survey. 2015[cited 2020 Mar 12].Available www.cdc.gov.

[3] Rejani R, Ratan R. Hand hygiene practices among health workers in a tertiary care hospital. International journal of science and research. Apr 2018[cited 2020 Mar 12];07 (4):pp 85-89.Available from: www.icmr.nic.in.

[4] Anargh V, Hand hygiene practices among health care workers in a tertiary care hospital in pune. Medical journal, Armed forces India.Jan 2013 [cited 2020 Mar 6]; 7 (4): 338-347.Available:w ww.ncbi.nlm.nih.gov.

[5] Bischoff EW, Reynolds TM Sessler TM.Hand washing compliance by health care workers-The impact of introducing an accessible alcohol based handrub. Arch Intern Med. 2000 Apr 10 [cited 2020 Mar 11]; 160 (7). pp 1017-1021. Available :www.ncbi.nlm.nih.gov.

[6] Keller J, Wolfensberger A, Clack L, Kuster SP, Dunic M, Eis D, Flammer Y, Keller DI et al.Do wearable alcohol-based handrub dispensers increase hand hygiene compliance?.2018[cited 2020 Mar 14]: 143.Available https://link.springer.com.

[7] Saito H, Inoue K, Ditai J, Wanume B, Abeso J, Balyejussa, Weeks A.Alcohol-based hand rub and incidence of healthcare associated infections in a rural regional referral and teaching hospital in Uganda ('WardGel' study). 2017 Dec 28 [cited 2020 Mar 18]; 6.18-49. Available:https://europepmc.org/article/me.

[8] Pires D, Soule H, Bellissimo-Rodrigues F, Gayet-Ageron A, Pittet D. On Hand Hygiene With Alcohol-Based Hand Rub: How Long Is Long Enough?.2017 May [cited 2020 Mar 1];38 (5):547-552.Available :https://www.ncbi.nlm.nih.gov/pubmed.

[9] Picheansathian W.Effectiveness of Alcohol-based solutions for Hand Hygiene: A Systematic Review. 2004 [cited 2020 Mar 2]; 2 (9): 1-27. Available: https://www.ncbi.nlm.nih.gov/pubmed.

[10] Sharma S, Sharma S, Puri S, Whig J.Hand hygiene compliance in the intensive care units of a tertiary care hospital.Indian J Community Med. 2011 Jul [cited 2020 Mar 3];36 (3):217-21. Available:www.ncbi.nlm.nih.gov/pubmed.

[11] Maury E, Alzieu M, Baudel JL, Haram N, Barbut F, Guidet B, Offenstadt G.Availability of an alcohol solution can improve hand disinfection compliance in an intensive care unit. Am J Respir Crit Care Med. 2000 Jul [cited 2020 Mar 02];162 (1):324-7.Available : www.ncbi.nlm.nih.gov/pubmed.

[12] Asma F A, Kheraiji, Bashayer, AlMalki, Nuha S, AlHammad et al.Assessment by WHO's My 5 moments of Hand Hygiene Shows inadequate knowledge and its translation into practices for hand washing behaviour among Saudi medical students.

International Annals of Medicine. 2018 Jan [cited 2020 Mar 09]; 2 (1).Available : pdfs.semanticscholar.org.
[13] Sunkesula VC, Meranda D, Kundrapu S, Zabarsky TF, McKee M, Macinga DR, Donskey CJ·Comparison of hand hygiene monitoring using the 5 Moments for Hand Hygiene method versus a wash in-wash out method. American journal of infection control. Jan 01, 2015[cited 2020 Mar 12]; 43 (1), 1-98. Available: https://www.ajicjournal.org/article/S0196-6553 (14)01212-7.
[14] Kenneth I. Onyedibe, Nathan Y. Shehu, Daniela Pires, Samson E. Isa, Mark O Okolo, Simji S. Gomerep on Assessment of hand hygiene facilities and staff compliance in a large tertiary health care facility in northern Nigeria: a cross sectional study. Antimicrob Resist Infect Control. 2020 Feb [cited 2020 Mar 09].Available https://link.springer.com.
[15] Jemal S, Knowledge and practices of hand washing among health professionals in Dupti referral hospital Ethiopia. International reasrch publish journal. Aug 2008 [cited 2020 Mar 14]: 88- 28 Available on www.medpub.in

CHAPTER VIII

Bibliography

[16] Sharma K S, Nursing Research & Statistics; Elsevier: Haryana, 2011. P 10-100.
[17] Basavanthappa B T, Nursing Research, Second Edition: Jaypee Brothers Medical Publishers: New Delhi, 2007. P 40-98
[18] Vaishali D T, Hand Book of Nursing Research & Biostatistics, First Edition: Jaypee Brothers Medical Publishers: New Delhi, 2008. P50-70
[19] V Muralidhar, Hospital Acquired Infections: Power Strategies for Clinical Practice, First Edition: Anshan Publishers: New Delhi, 2007. P 78-94
[20] Purva Mathur, Hospital Acquired Infections, First edition: Lippincott Williams & Willkins Publishers: New Delhi, 2010. P 112-1461.
[21] World Health Organization. Patient safety. Save lives. Clean your Hands. Health care associated infections. Fact sheeet.2010 Apr 30[cited 2020 Feb 27]World Health Organisation. Safety checklist WHO 5 moments of hand hygiene. https://www.who.int/infection-prevention/campaigns/clean-hands/5moments/en.
[22] Centers for disease control and prevention.CDC 24/7:Saving Lives, protecting people.HAI hospital prevalence survey. 2015[cited 2020 Mar 12].Available www.cdc.gov.
[23] Anargh V, Hand hygiene practices among health care workers in a tertiary care hospital in pune. Medical journal, Armed forces India. Jan 2013 [cited 2020 Mar 6]; 7 (4): 338-347.Available:w ww.ncbi.nlm.nih.gov.
[24] Yawson AE, Hesse JE, Hand hygiene practices and resources in a teaching hospital in Ghana.J Infect Dev Ctries 2013 [cited 2020 Mar 10];27-1003 Available:www.jidc.org.
[25] Sharma S, Sharma S, Puri S, Whig J.Hand hygiene compliance in the intensive care units of a tertiary care hospital. Indian J Community Med. 2011 Jul [cited 2020 Mar 3];36 (3):217-21. Available:www.ncbi.nlm.nih.gov/pubmed.
[26] Tschudin-Sutter S, Pargger H, Widmer AF.Hand hygiene practices in an intensive care unit. Crit care med.Aug 2010 [cited 2020 Mar 03];38 (8):299-305. Available:www.ncbi.nlm.nih.gov/pubmed.
[27] Kanitha, Hand hygiene and attitude of HCWs in an intensive care unit. Journal of health research. Jan 2005 [cited 2020 Mar 14]: 106-44 Available on www.ncbi.nlm.nih.gov.
[28] Kenneth I. Onyedibe, Nathan Y. Shehu, Daniela Pires, Samson E. Isa, Mark O Okolo, Simji S. Gomerep on Assessment of hand hygiene facilities and staff compliance in a large tertiary health care facility in northern Nigeria: a cross sectional study.Antimicrob Resist Infect Control. 2020 Feb [cited 2020 Mar 09].Available https://link.springer.com.
[29] www.cdc.gov
[30] www.who.gov.in
[31] www.pubmed.gov
[32] www.medline.com
[33] http://www.ncbi.nlm.nih.gov
[34] http://globalhandwashing.org
[35] http://www.researchgate.net

Annexure III

Annexure-III

S No	Assessment Criteria	Opportunity		Adherence		Missed	
		Yes (1)	No (0)	Yes (1)	No (0)	Yes (1)	No (0)
1	Before patient contact						
2	Before aseptic task						
3	After body fluid exposure						
4	After patient contact						
5	After contact with patient's surrounding						
	Total						

Demographic Data

Annexure IV

SNO	Service number	Age	<20 Yrs	21-29 Yrs	30-39 Yrs	>40 Yrs	Years of service	1-5 yr	6-10 yr	11-15 yr	16-20 yr	21-25 yr	26-30 yr	Doctors	Nurses	Paramedical Staff	Diploma	Graduate	Post-Graduate
1	NR21243Y	40	0	0	0	1	16	0	0	0	1	0	0	0	1	0	1	0	0
2	NR23394W	29	0	1	0	0	6	1	1	0	0	0	0	0	1	0	1	0	0
3	NR 21570K	36	0	0	1	0	13	0	0	1		0	0	0	1	0	0	0	1
4	NR21744Y	33	0	0	1	0	12	0	0	1	0	0	0	0	1	0	0	0	1
5	NR23058K	30	0	0	1	0	7	1	1	1	0	0	0	0	1	0	1	0	0
6	NS24301H	27	0	1	0	0	3	1	0	0	0	0	0	0	1	0	0	0	1
7	NR20495Y	44	0	0	0	1	24	0	0	0	0	1	0	0	1	0	1	0	0
8	NS23218Y	32	0	0	1	0	7	0	1	0	0	0	0	0	1	0	0	0	1
9	NR24724W	23	0	1	0	0	23	0	0	0	0	1	0	0	1	0	1	0	0
SNO	Service number	Age	<20 Yrs	21-29 Yrs	30-39 Yrs	>40 Yrs	Years of service	1-5 yr	6-10 yr	11-15 yr	16-20 yr	21-25 yr	26-30 yr	Doctors	Nurses	Paramedical Staff	Diploma	Graduate	Post-Graduate
10	NR23856X	26	0	1	0	0	5	1	0	0	0	0	0	0	1	0	1	0	0
11	NR22997A	32	0	0	1	0	7	0	1	0	0	0	0	0	1	0	0	0	1
12	NR22002L	42	0	0	0	1	10	0	1	0	0	0	0	0	1	0	0	0	1

13	NR22910N	23	0	1	0	0	8	0	1	0	0	0	0	0	1	0	1	0	0
14	NR23051A	30	0	0	1	0	7	0	1	0		0	0	0	1	0	1	0	0
15	NR22978P	30	0	0	1	0	7	0	1	0	0	0	0	0	1	0	0	0	1
16	NS24493L	31	0	0	1	0	3	1	0	0	0	0	0	0	1	0	0	0	1
17	NR21629Y	35	0	0	1	0	14	0	0	1	0	0	0	0	1	0	1	0	0
18	MR08730A	41	0	0	0	1	16	0	0	0	1	0	0	1	0	0	0	1	0
19	NS25136P	29	0	1	0	0	2	1	0	0	0	0	0	0	1	0	0	0	1
SNO	Service number	Age	<20 Yrs	21-29 Yrs	30-39 Yrs	>40 Yrs	Years of service	1-5 yr	6-10 yr	11-15 yr	16-20 yr	21-25 yr	26-30 yr	Doctors	Nurses	Paramedical Staff	Diploma	Graduate	Post-Graduate
20	NR24028Y	25	0	1	0	0	4	1	0	0	0	0	0	0	1	0	1	0	0
21	NR24052P	25	0	1	0	0	4	1	0	0	0	0	0	0	1	0	1	0	0
22	NR24526X	29	0	1	0	0	3	1	0	0	0	0	0	0	1	0	1	0	0
23	NS23102H	30	0	0	1	0	6	0	1	0	0	0	0	0	1	0	1	0	0
24	MS20212M	28	0	1	0	0	1	1	0	0	0	0	0	1	0	0	0	0	1
25	NR25302X	23	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1
26	NR23982K	26	0	1	0	0	5	0	0	0	0	0	0	0	1	0	0	0	1
27	MR07871H	39	0	0	1	0	17	0	0	0	1	0	0	1	0	0	0	1	0
28	MS17112W	31	0	0	1	0	7	0	1	0	0	0	0	1	0	0	0	0	1
29	NR20311P	44	0	0	0	1	24	0	0	0	0	1	0	0	1	0	0	1	0
30	NR 21266A	39	0	0	1	0	17	0	0	0	1	0	0	0	1	0	0	0	1
SNO	Service number	Age	<20 Yrs	21-29 Yrs	30-39 Yrs	>40 Yrs	Years of service	1-5 yr	6-10 yr	11-15 yr	16-20 yr	21-25 yr	26-30 yr	Doctors	Nurses	Paramedical Staff	Diploma	Graduate	Post-Graduate
31	OR15437525W	30	0	0	1	0	9	0	1	0	0	0	0	0	0	1	1	0	0
32	OR15427501K	30	0	0	1	0	12	0	0	0	0	0	0	0	0	1	1	0	0
33	OR154506 57N	26	0	1	0	0	7	0	1	0	0	0	0	0	0	1	1	0	0
34	NS23087Y	28	0	1	0	0	7	0	1	0	0	0	0	0		0	1	0	0
35	MS 16657F	33	0	0	1	0	10	0	1	0		0	0	1	1	0	0	0	1
36	MS 16676M	33	0	0	1	0	10	0	1	0	0	0	0	1	0	0	0	0	1
37	MR08755M	38	0	0	1	0	15	0	0	1	0	0	0	1	0		0	1	0
38	MR06770H	46	0	0	0	1	25	0	0	0	0	1	0	1	0	0	0	1	0
39	NS25075H	23	0	1	0	0	2	1	0	0	0	0	0	0	1	0	1	0	0
40	MS17236L	28	0	1	0	0	7	0	1	0	0	0	0	1	0		0	0	1
41	MS16928W	32	0	0	1	0	8	0	1	0	0	0	0	1	0	0	0	0	1
SNO	Service number	Age	<20 Yrs	21-29 Yrs	30-39 Yrs	>40 Yrs	Years of service	1-5 yr	6-10 yr	11-15 yr	16-20 yr	21-25 yr	26-30 yr	Doctors	Nurses	Paramedical Staff	Diploma	Graduate	Post-Graduate
42	MR06363A	50	0	0	0	1	28	0	0	0	0	0	1	1	0	0	0	1	0
43	MR07985N	44	0	0	0	1	21	0	0	0	0	1	0	1	0	0	0	1	0
44	MR07818X	45	0	0	0	1	21	0	0	0	0	1	0	1	0	0	0	1	0
45	MR08695H	42	0	0	0	1	15	0	0	1	0	0	0	1	0	0	0	1	0
46	MR-08236K	40	0	0	0	1	18	0	0	0	1	0	0	1	0	0	0	1	0
47	MR 08730A	51	0	0	0	1	29	0	0	0	0	0	1	1	0	0	0	1	0
48	MS-NYA	30	0	0	1	0	1	1	0	0	0	0	0	1	0	0	0	1	0
49	NS25117K	32	0	0	1	0	1	1	0	0	0	0	0	0	1	0	0	0	1
50	NR23841P	25	0	1	0	0	5	0	0	0	0	0	0	0	1	0	1	0	0

Master Sheet Annexure V

S. No	Service number	Before patient contact	Before aseptic task	After body fluid exposure	After patient contact	After contact with patient surroundings	Opportunity	Adherence	Missed
1	NR21243Y	0	1	1	0	0	5	2	3
2	NR23394W	1	1	1	0	0	5	3	2
3	NR 21570K	0	0	1	1	0	5	2	3
4	NR21744Y	1	1	1	1	0	5	4	1
5	NR23058K	0	0	1	1	0	5	2	3

6	NS24301H	0	1	1	0	0	5	2	3
7	NR20495Y	0	-	-	0	1	3	1	2
8	NS23218Y	0	1	0	0	0	5	1	4
9	NR24724W	0	1	1	0	0	5	2	3
10	NR23856X	0	1	1	0	0	5	2	3
11	NR22997A	0	1	1	1	0	5	3	2
12	NR22002L	0	0	1	0	0	5	1	4
13	NR22910N	0	1	1	0	0	5	2	3
14	NR23051A	0	1	1	0	1	5	3	2
15	NR22978P	0	1	0	0	0	5	1	4
16	NS24493L	0	1	1	0	1	5	3	2
17	NR21629Y	0	0	1	1	0	5	2	3
18	NS25136P	1	1	1	0	0	5	3	2
19	NR24028Y	0	1	1	0	0	5	2	3
S. No	Service number	Before patient contact	Before aseptic task	After body fluid exposure	After patient contact	After contact with patient surroundings	Opportunity	Adherence	Missed
20	NR24052P	0	1	0	1	0	5	2	3
21	NR24526X	0	1	1	0	0	5	2	3
22	NS23102H	0	1	0	0	0	5	1	4
23	NR25302X	0	0	1	0	0	5	1	4
24	NR23982K	0	1	1	0	0	5	2	3
25	NR20311P	0	1	1	1	0	5	3	2
26	NR 21266A	0	1	1	0	1	5	3	2
27	NS23087Y	0	1	1	1	0	5	3	2
28	NS25075H	0	1	1	0	0	5	2	3
29	NS25117K	0	1	1	1	0	5	3	2
30	NR23841P	0	1	1	0	0	5	2	3
31	MR08730A	0	-	-	0	0	3	0	3
32	MS20212M	0	1	0	0	0	5	1	4
33	MR07871H	0	-	-	0	0	3	0	3
34	MS17112W	0	1	1	0	0	5	2	3
35	MS 16657F	0	1	1	0	0	5	2	3
36	MS 16676M	0	1	1	0	0	5	2	3
37	MR08755M	0	1	-	0	0	4	1	3
38	MR06770H	0	-	-	0	0	3	-	3
39	MS17236L	0	-	0	0	0	4	-	4
40	MS16928W	0	1	0	0	0	5	1	4
41	MR06363A	0	-	0	0	1	4	1	3
S. No	Service number	Before patient contact	Before aseptic task	After body fluid exposure	After patient contact	After contact with patient surroundings	Opportunity	Adherence	Missed
42	MR07985N	0	-	0	0	0	4	-	4
43	MR07818X	0	-	0	0	0	4	-	4
44	MR08695H	0	-	0	0	0	4	-	4
45	MR-08236K	0	-	0	0	0	4	-	4
46	MR 08730A	0	-	-	0	0	3	-	3
47	MS-NYA	0	-	-	0	0	3	-	3
48	OR15437525W	1	-	0	1	0	4	2	2
49	OR15427501K	1	-	0	1	0	4	2	2
50	OR 154506 57N	0	1	1	1	0	5	3	2
	TOTAL	5	31	29	12	5	229	82	147