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Assessment of the cleaning and disinfection practices among healthcare workers in Intensive Care Units (ICUs) post-patient discharge

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Cover Page Footnote

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Assessment of the cleaning and disinfection practices among healthcare workers in Intensive Care Units (ICUs) post-patient discharge

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Abstract

Introduction: Patients being admitted to the intensive care unit (ICU) pose a risk of developing common healthcare-acquired infections. Healthcare workers (HCWs) must be well-equipped and knowledgeable to deliver effective cleaning and disinfection protocols to reduce the chances of hospital-acquired infections. **Objective:** This study aimed to assess the knowledge and practice of cleaning and disinfection after the discharge/death of patients among the HCWs in selected ICUs. **Methods:** A cross-sectional descriptive survey was conducted in selected ICUs of a tertiary care hospital. A purposive sampling technique was used to select the participants which included 106 staff nurses and 47 housekeeping staff and 110 events of cleaning and disinfection were observed. A structured knowledge questionnaire was used to collect the knowledge among the participants and a practice checklist was used to collect the practice regarding cleaning and disinfection separately from both staff nurses and housekeeping staff. The study was analyzed using descriptive and inferential statistics. **Results:** Good knowledge was reported among 75 (70.8%) nursing staff and 28 (59.6%) housekeeping staff on cleaning and disinfection. It was found that in all the observed events, 110 (100%) of the HCWs had worn gloves and discarded the single-used items and linens of the patients. **Conclusions:** Most of the HCWs used good barrier techniques while at work and cleaning and disinfection practices were found to be appropriate in maintaining the ideal infection control practices in ICUs with compliance with the hospital policies.

Keywords: cleaning, disinfection, healthcare workers, intensive care unit, nurses, practice

Introduction

The cleaning of hospital surfaces and rooms is essential for reducing hospital-related infections. ICU patients are at a higher risk for acquiring hospital-associated infections (HAI) as the patients are critically ill and cannot fight against the infections. Environmental hygiene plays a crucial role in preventing HAIs as the pathogens stay longer over the surfaces. These practices have a greater impact on the financial, scientific, and

social expenses of patients and hospitals (Han et al., 2015; Pyrek, 2017). It is suggested that cleaning must be assessed by numerous approaches, not only one. Also, training the staff that carries out the cleaning and rewarding correct performance by giving feedback are significant tactics to increase the competence of cleaning (Gülsoy & Karagozoglu, 2021). A hand hygiene compliance study among HCWs in ICUs reported the practice of hand hygiene depending on the sense of “dirtiness” and “cleanliness”. Some of the participants indicated that on-job training delivered by the infection control team changed their perception of “emotional” based hand hygiene to “indication” based. Direct observations and individual feedback on a one-to-one basis were the core of this training (Ay et al., 2019).

Biofilm formation, even on dry surfaces, may play a role in reducing the efficacy of terminal cleaning procedures since it allows bacteria to survive in the

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atmosphere for a long period and provides increased resistance to commonly used disinfectants. HCWs should be thorough regarding the environmental contamination in the ICU and consider it in the wider viewpoint of infection control measures and stewardship initiatives (Russotto *et al.*, 2017).

The patient care equipment and surfaces play a significant role in the transmission of infection, which needs to be cleaned to prevent the colonization of bacteria. Both critical and non-critical equipment in the ICUs needs to be disinfected using a low or intermediate level of disinfectant as it carries a potential risk of secondary transmission (McGoldrick, 2009; Osman & Askari, 2014; Rutala & Weber, 2008).

Nurses and other healthcare support teams with advanced educational status and good awareness regarding the risk of transmitting an infectious disease at work were more likely to perform correct antiseptic procedures and effectively implement hospital protocols (Ragusa, Lombardo, Bruno, Sciacca, & Lupo, 2016; Sessa, Di Giuseppe, Albano, Angelillo, & Group, 2011). Not adhering to the best cleanliness practices indicated the necessity to plan and implement standard policies for infection control in the ICUs as well as highlighted continuous and vigorous sensitization to improve competency (Kennedy, Elward, & Fraser, 2004; Kernéis & Lucet, 2019; Musu *et al.*, 2017; Pittet, 2001; Sukhlecha, Vaya, Parmar, & Chavda, 2015).

Objectives

- To assess the knowledge of cleaning and disinfection among HCWs through a structured knowledge questionnaire
- To assess the practice of cleaning and disinfection among HCWs through an observational checklist

Materials and Methods

This cross-sectional survey was conducted in a tertiary care hospital in Karnataka, India. The study was conducted among the HCWs, including 106 staff nurses and 47 housekeeping staff working in selected ICUs, which were selected using a nonprobability purposive sampling technique.

Since the event of cleaning and disinfection is not a scheduled activity and is frequently carried out as and when the requirement was raised, it was decided to include all the staff working in the respective ICUs for the data collection process. The inclusion criteria for the assessment of knowledge were HCWs who are working in ICU, and the HCWs present during the time of data collection. The inclusion criteria for observation of practice were observing events based on a checklist and events that occur after the discharge or transportation of a patient from the ICU. Events observed included arranging the articles required for surface disinfection, discarding or transfer of all types of equipment used, and use of personal protective equipment (PPE). The observation also included cleaning and disinfection of equipment, beds, and the surroundings of the bed. The only exclusion criteria were any events that occur during the absence of the researcher. Ethical permission was obtained from the institutional ethics committee (IEC No; IEC 773/2016, CTRI No; REF/2016/12/012880) of the selected tertiary care hospital in the southern part of India.

The data was collected from 4 January to 5 February 2018 after obtaining administrative permissions. Informed consent was taken from the participants after explaining the procedure and a participant information sheet was given to each participant. The researcher developed a demographic proforma, a knowledge questionnaire, and an observational checklist for cleaning and disinfection after a thorough literature review and expert suggestions. To establish validity, the tools were given to a panel of seven experts from the field of Infection Control, Microbiology, and the Nursing department. The content validity index (CVI) of the tools was obtained, and a CVI of less than 0.8 was removed. The knowledge questionnaire and the demographic proforma for the housekeeping staff were translated into Kannada, the native language of the state, as they were more comfortable in this language than in English. A pilot study was conducted in a similar setting to see the feasibility. The sampling technique used for the knowledge questionnaire was purposive sampling,

and for observation, event sampling was used. The statistical formula for calculating the sample size was by absolute precision and the sample size calculated for the study was 92 events including the cleaning and disinfection after discharge/death of patients, and the events finally observed were 110. Using enumerative sampling, 106 staff nurses and 47 housekeeping staff that was present during the data collection time were selected. The researcher went to various ICUs at different points of time to assess the cleaning and disinfection practices after the discharge of patients for the procedures performed by the HCWs. Each HCW was observed a maximum of five times.

The survey captured the socio-demographic data of the respondents, which consisted of eight items. A structured knowledge questionnaire was administered to the staff nurses and the housekeeping staff on cleaning and disinfection, which consisted of 28 items. Each item had four options from which participants were instructed to select one correct answer. Each item carried one mark. Thus, the total score for this tool was 28, which was categorized into Excellent (21-28), Good (14-20), Satisfactory (7-13), and Poor (0-6). An observation checklist developed by the researcher consisting of 39 items was used to assess the practices of HCWs after the discharge of the patient. The checklist was scored as one for performed and zero for not performed or

incompletely performed steps. Data analysis was done using descriptive statistics using SPSS version 16. The results were presented as frequency and percentage.

Results

A total of 183 HCWs consented to take part in the study among 198 approached, giving a response rate of 92.42%. In addition, the researcher observed 110 events about cleaning and disinfection practices.

Socio-demographic data among staff nurses

The majority of the study participants were females 90 (84.9%), in the age group of 20-30 (87.7%). Most of the staff nurses were general nursing and midwifery (GNM) qualified 57 (53.8%) and BSc-qualified 44 (41.5%). Concerning experience, 46 (43.4%) of the staff nurses were having nearly up to years of working experience in the ICU. Half of the participants, 50 (47.2%) had attended classes on cleaning and disinfection (Table 1).

Socio-demographic data among housekeeping staff

The majority of the study participants were females 34 (72.3%). Most 45 (95.8%) of the participants had education up to the 10th standard. The majority 42 (89.4%) of the participants had more than one year of experience in the ICU. All 47 (100%) of the participants had attended classes on cleaning and disinfection (Table 1).

Table 1
Socio-demographic characteristics among HCWs

Variables	Staff nurses (n=106)		Housekeeping staff (n=47)	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Age in years				
20-30	93	87.7	24	51
31-50	13	12	23	49
Gender				
Male	16	15.1	13	27.7
Female	90	84.9	34	72.3
Work area				
ICU 1	28	26.4	12	25.5
ICU 2	28	26.4	13	27.7
ICU 3	20	18.9	12	25.5
Casualty ICU	30	28.3	10	21.3
Classes on cleaning and disinfection				
Yes	50	47.2	47	100
No	56	52.8	0	0

Knowledge level of staff nurses regarding cleaning and disinfection procedures

Among 106 staff nurses, 12 (11.3%) had excellent knowledge, and 70 (70.8%) had good knowledge indicating that the majority had good awareness regarding cleaning and disinfection procedures (Figure 1).

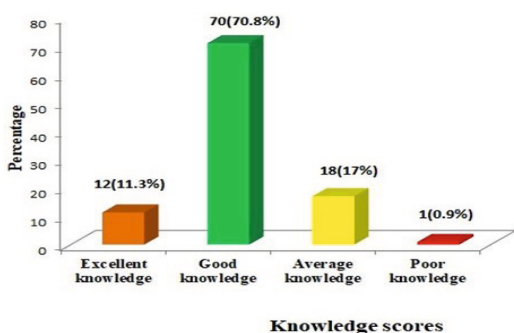


Figure 1: Knowledge of staff nurses on cleaning and disinfection procedure

Knowledge level among housekeeping staff

Among 47 housekeeping staff, nine participants (19.1%) had excellent knowledge and 28 (59.6%) had good knowledge indicating that most of them possessed adequate knowledge regarding cleaning and disinfection practices (Figure 2).

N= 47

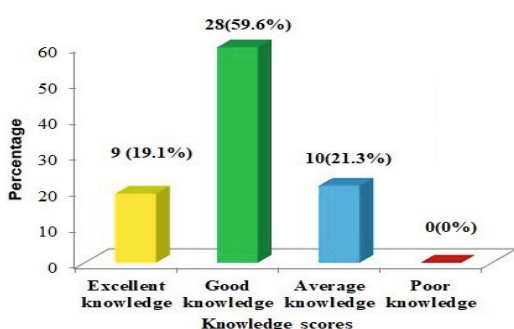


Figure 2: Knowledge of housekeeping staff on cleaning and disinfection

Events observed based on the type of discharge

Among 110 observations, the transfer of 85 (77.3%) was reported as the most common form of transfer method from the ICUs.

The practices were observed after the discharge or transfer of patients from the ICUs based on the checklist (Table 2).

Table 2

Frequency and percentage of the practices on cleaning and disinfection among housekeeping staff in ICU

N=110

Criteria	Yes		No	
	(f)	(%)	(f)	(%)
Arranges all the articles required for surface disinfection:				
Uses two basins – one for water and the other for the disinfectant solution	104	94.5	6	5.5
Uses disinfectant- Virkon	104	94.5	6	5.5
Uses fresh clothes/mops	5	4.5	105	
Wears a pair of gloves	110	100	0	0
Prepares the fresh disinfectant solution as per the label instructions	110	100	0	0
Discards/transfers single patient use items	110	100	0	0
Discards the linen into hamper bags	110	100	0	0
Urinals	27	24.5	0*	0*
Bedpan	38	34.5	0*	0*
Suction tubing	78	70.9	0*	0*
Uses personal protective equipment	104	94.5	6	5.5

* Not applicable items

N = Number of events observed

The mops used for cleaning were not fresh each time they were used. The same cloth/mop was used for cleaning the equipment as well as the beds and environmental surroundings. According to the hospital routine, the new solution was prepared daily in the morning shift and discarded at the end of the day. Only five (4.5%) fresh clothes were used to clean the beds and surfaces (Table 2).

Only 27 (24.7%) urinals and 38 (34.5%) bedpans were discarded or transferred after the transfer/discharge of the patient. In the ICUs, the majority of the patients were on Foley’s catheters and therefore the urinals and bedpans were not applicable. Whereas in other ICUs, where the patients were not on Foley’s catheter, they had their bedpans and urinals, and these were transferred along with the patient. The suction tubing was discarded after the transfer or discharge of the patient (Table 2).

Data on cleaning of the equipment is shown in table-3. The equipment was cleaned and disinfected only after the death of a patient under the supervision of a staff nurse and was not cleaned after each transfer out. Soon after the transfer or death of the patient, the staff nurses switched off all the monitors (Table 3).

Table 3
Frequency and percentage of the practices on cleaning and disinfection of various equipment among HCWs in ICU
N=110

Criteria	Yes		No		Remarks
	(f)	(%)	(f)	(%)	
Cleaning and disinfection of equipment:					
Make sure that all the monitors are switched off	110	100	0	0	Nursing staff
Dip the cloth into the solution	14	12	96	87.3	Housekeeping staff
Start by cleaning the:					
Cardiac monitor	14	12	96	87.3	Housekeeping staff
Pulse oximeter probes	14	12	96	87.3	Housekeeping staff
Infusion pumps	14	12	96	87.3	Housekeeping staff
Syringe pumps	14	12	96	87.3	Housekeeping staff
Mechanical ventilator					

N = Number of events observed

Data on practices on cleaning and disinfection of beds and surroundings among housekeeping staff (Table 4). The mackintosh was cleaned under running water or with 1% hypochlorite. If the patient was infected, then the water mattress was disinfected with the Virkon solution after the discharge or transfer of the patient. The entire patient care environment was disinfected in the morning shift by the housekeeping staff under the supervision of the ward in charge of the shift (Table 4).

The mopping of the floor was done thrice a day by the housekeeping staff. In all the ICUs, weekly twice mechanical floor cleaning was done by a group of trained housekeeping staff using ten litres of water in 100 ml of Schevaran by a vacuum machine under the supervision of the ward in charge or the housekeeping supervisor (Table 4).

Table 4
Frequency and percentage of the practices on cleaning and disinfection of beds and surroundings among housekeeping staff in ICU
N=110

Criteria	Yes		No	
	(f)	(%)	(f)	(%)
Cleaning and disinfection of beds:				
Dip the cloth into the solution	104	94.5	6	5.5
Start by cleaning the:				
Top and sides of the mattress	104	94.5	6	5.5
Wiping the horizontal surfaces	104	94.5	6	5.5
The bed frames	104	94.5	6	5.5
The bed controls	49	44.5	61	55.5
The footboard of the bed	99	90	11	10
The headboard of the bed	102	92.7	8	7.3
Bed rails	104	94.5	6	5.5
Cleaning and disinfection of the surroundings of the bed:				
Clean the table tops	101	91.8	9	8.2
IV poles	54	49.1	56	50.9
The shelf behind the bed	100	90.9	10	9.1
Cupboard used by the patient	102	92.7	8	7.3
Suction tops	98	89.1	12	10.9
Oxygen flow meter	100	90.9	10	9.1
Leave all the disinfected surfaces for air dry	104	94.5	6	5.5
Mop the floor with the disinfectant	15	13.6	95	86.4
Cleaning of the user equipment with the solution	104	94.5	6	5.5
Discarding the solution used	7	6.4	103	93.6
Replacing of the equipment used for cleaning	104	94.5	6	5.5
Hand washing	96	87.3	14	12.7

N=Number of events observed

Discussion

The present study reported that the majority of the HCWs were aware of cleaning and disinfection practices after the discharge of the patients and it was found that their practice was in adherence with the hospital protocol. Environmental service workers in a study on cleaning and healthcare-associated infections reported that they were adequately trained to do the daily (91%) and discharge (95%) cleaning and were “very confident” in their capabilities to perform so (80% and 88%, respectively). But 63% of workers expressed that they were “not always” clear on what items environmental service workers were responsible for cleaning (Bernstein et al., 2015). In another

study conducted to assess the knowledge, attitude, and practices of nurses on disinfection procedures among eight non-academic acute general public hospitals in Italy, it was found that the majority of the nurses' knowledge was considerably greater in those with a higher level of education and 77.6%-96.4% agreed that the inappropriate disinfection procedure could lead to a higher risk of acquiring infection from a patient to an HCW (Sessa, Di Giuseppe, Albano, Angelillo, & Group, 2011).

Similarly, in a descriptive study conducted among 280 healthcare personnel (83 nursing personnel), 209 (82.3%) were aware of sterilization, disinfection, and asepsis; and 174 (68.5%) were aware of sterilization practices (Sukhlecha *et al.*, 2015). In another study that assessed the level of knowledge and awareness among different levels of HCWs about sterilization among 85 nursing staff and 105 paramedical staff, it was found that the nursing staff had more knowledge than the paramedical staff (Carling, Von Beheren, Kim, & Woods, 2008). Nurses with higher educational levels and higher perceptions of the risk of transmitting an infectious disease at work were more likely to perform appropriate antisepsis of the surgical wound and handwashing (Sessa, Di Giuseppe, Albano, Angelillo, & the Collaborative Working, 2011).

Before performing discharge cleaning, 96 (87.3%) of the housekeeping staff washed their hands, as well as 104 (94.5%) of them, used PPE for cleaning procedures. In a descriptive and cross-sectional study to know the practice regarding sterilization among healthcare staff, it was observed that 195 (76.8%) of the staff before and after handling patient washed their hands with antiseptic and 162 (63.8%) used personal protective measures like gloves, masks, glasses, caps, and apron while handling patients/blood/tissues, etc. Among the participants, 135 (53.2%) observed the sterilization process in the hospital and 103 (40.6%) had received educational sessions on the use of autoclaves for linen and instruments as per protocol (Sukhlecha *et al.*, 2015). Lack of

knowledge of guidelines for hand hygiene, lack of recognition of hand hygiene opportunities during patient care, and lack of awareness of the risk of cross-transmission of pathogens are barriers to good hand hygiene practices (Tschudin-Sutter, Pargger, & Widmer, 2010).

In this present study, among 110 events of cleaning and disinfection observed, it was found that 91.8% of table tops, 90.9% of a shelf behind the bed, 92% of cupboards used by the patient, and 94.5% of bed rails were disinfected after the transfer of the patient. Only 15 (13.6%) observations of events reported having the floors disinfected after the death of the patient but not after transfer outs or discharge. These findings are supported by a study conducted among 16 hospitals in the United States of America to assess the environmental cleaning in ICUs and it was found that 71.4% of bedside tables and 63% of side rails were cleaned and they concluded that cleaning of high-risk objects in ICUs following transfer or discharge of the patient is an integral part of environmental hygiene in hospitals as there is an increased risk of infection (Bhandari & Bande, 2016). Hong Kong hospital study contradicts the findings of the present study as it reports that, the support workers in their hospital failed to disinfect the environmental surfaces such as doorknobs, handles, and floors after the discharge of a patient (Tenna *et al.*, 2013).

Conclusion

Although specific precautions are taken care of in the ICU, zero risks cannot be obtained. We can assure that the healthcare personnel are well trained and they can implement adequate protocols and procedures to ensure good quality of care. The outcome of our study suggests that although healthcare professionals are made aware of specific precautions to be taken in an ICU, it is even essential to sensitize the staff frequently with continuing education programs so that they can adhere to best practices in the clinical. Even though most of the events observed showed compliance with the hospital policies, cleaning of

the floors after the discharge needs to be reinforced to ensure proper cleaning and disinfection. Finally, the next stage will be to clarify the specific roles performed by different HCWs for controlling hospital infections, keeping the fact that cleaning and disinfection of environmental services must always be accompanied by the implementation of standard infection control procedures.

Preventive education regarding good cleaning and disinfection practices among HCWs should be incorporated at the entry level and training of these HCWs should be done on regular basis. There is a need to develop strategies in the form of conducting frequent audits to improve the cleaning and disinfection and hospital hygiene ensuring safe patient care.

Since the study was done on a representative sample, the findings of the study cannot be generalized and were limited only to the selected ICUs under study. In addition, the practice may differ according to hospital policy. As the study was time-bound, only limited events were observed in cleaning and disinfection. Moreover, observation timings were not randomly selected.

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