



Research article

Nurses' cleaning practice of non-critical medical equipment in the era of COVID 19: A cross-sectional study in Debre-Tabor comprehensive specialized hospital

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ABSTRACT

Objectives: This study was aimed at assessing the cleaning practice of non-critical medical equipment (NCME) in the era of corona virus disease-2019 of nurses working in Debre-Tabor comprehensive specialized hospital (DTCSH), north-central Ethiopia.**Design:** Facility based cross-sectional study was conducted in DTCSH, Ethiopia, from July 05 to August 05, 2020.**Setting:** The study was conducted in inpatient and outpatient units of the hospital.**Participants:** A total of 76 randomly selected staff nurses and 6 head nurses were included for observational study and interview respectively.**Results:** Only 1.3%–5.3% of nurses cleaned stethoscopes, thermometers, pulse oximeters, and glucometers right after using these devices for patients. None of them cleaned the blood pressure apparatus before or after checking a patient's blood pressure and glucometer before determining blood glucose levels. Lack of disinfecting materials and lack of training on infection prevention were perceived by head nurses as major barriers for proper cleaning practices.**Conclusion:** Nurses' cleaning practice of NCME was very low. Therefore, proper supply of materials needed to clean these devices need to be secured. Besides, nurses need to get training on infection prevention.

1. Introduction

The pandemic corona virus disease-2019 (COVID-19) caused by the newly innovated coronavirus, severe acute respiratory syndrome corona virus-2 (SARS-CoV-2) still leads as a global threat of the era. It was first identified from patients with pneumonia of unknown etiology in Wuhan province of China by the end of 2019 [1]. COVID-19 is a highly contagious disease that spreads from one person to another rapidly. As of June 28, 2020, about 9,851,287 cases and 500,882 deaths owing to COVID-19 were reported from 216 countries [2]. A total of 5,689 cases and 98 deaths were also reported from Ethiopia until June 28, 2020 [3].

Researchers reported a high incidence of nosocomial COVID-19. The mortality rate was also found to be high in nosocomial COVID-19 [4]. Health care workers (HCWs) are getting infected at a higher rate. By July 2020, WHO reported about 10% of all COVID-19-infected cases globally

and more than 10,000 of the total cases in Africa to be HCWs. Lack of personal protective equipment and poor infection prevention practices were revealed to be major causes of infection in HCWs [5].

COVID-19 mainly transmits through close contact with infected individuals. However, indirect contact with inanimate surfaces near to infected persons or objects used on or by infected persons can occasionally expose to the virus [6, 7]. The indirect way of transmission was considered to be higher in health care institutions as these environments are at a continuous exposure to disease-causing and resistant micro-organisms including SARS-CoV-2 than another environment. Researchers isolated different micro-organisms from surrounding air, patient care items, patient charts, computer mouses, HCW's mobile, and other devices in a health care institution [8, 9, 10, 11]. A study done in Wuhan, China, also isolated SARS-CoV-2 in surrounding air and solid surfaces of intensive care units as well as general wards where patients with COVID-19 infection were admitted [7].

Medical equipment that comes in countless contact with patients and health care professionals are prone to be colonized by

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pathogenic micro-organisms. Stethoscope, blood pressure apparatus, thermometer, oxygen flow meter, pulse oximeter, glucometer, and the like are non-critical medical equipment (NCME) that have direct or indirect contact with patients and HCWs [12]. Unless these medical equipment are properly handled and cleaned, colonization by micro-organisms of these items is high. Studies conducted in India found bacterial colonization in 50.8% and 60% of stethoscopes [13, 14]. Micro-organisms were also identified from thermometers and blood pressure apparatuses [15, 16]. These devices could also be colonized by a coronavirus [17].

The center for disease prevention and control (CDC) recommends low-level disinfection for NCME. This equipment needs disinfection before and after patient contact, once daily or once weekly. If this is not possible, this equipment needs to be cleaned at least when visibly soiled [18]. In the era of COVID-19, disinfection by approved disinfectants is not only recommended for medical equipment but also to frequently touched surfaces out of health care settings [19]. Disinfection with different biocidal agents was found to be effective against COVID-19 [20]. Increasing the cleaning time of patient care equipment was suggested to be important in reducing environmental contamination and nosocomial infections [21].

However, HCWs usually fail to adhere to preventive strategies causing medical equipment to be colonized by microorganisms ultimately leading to nosocomial infection [22]. Hence, this study aimed at assessing the nurse's cleaning practice of NCME and providing sound recommendations.

2. Methods

2.1. Study design and setting

Facility-based cross-sectional study design was implemented from July 5 to August 5, 2020 at Debre-Tabor comprehensive specialized (DTCSH). DTCSH is located 665 kms from Addis Ababa in the north central part of Ethiopia. There are 152 nurse employees of the hospital working in different inpatient and outpatient units.

2.2. Eligibility criteria

Nurse employees of DTCSH available during the data collection period were included. Nurses on maternity, annual, or sick leave during the data collection period were excluded from the study.

2.3. Sample size determination and sampling technique

All nurses who were working in different units of the hospital during the data collection period were included in the study. **Besides, six head nurses were included for the interview.**

2.4. Data collection instrument and procedure

Data for the quantitative aspect of the study were collected from the study participants using structured observational checklist and interview guide adapted from CDC recommendations for instrument processing [18]. After getting permission from administrative offices of DTCSH four nurses who have MSc in nursing observed staff nurses' practice covertly. The principal investigator did the in-depth interview with head nurses after the covert observation is completed.

2.5. Study variables

The variables of this study were nursing cleaning practice of NCME, gender and working unit of the participant, and working shift when the data were collected.

2.6. Data processing and analysis

The collected data were cleaned, coded and entered into Epidata manager version 4.6 and then exported to SPSS window version 26 for analysis. Descriptive statistics were used to describe participants characteristics and cleaning practices. For the qualitative part of the study, data recorded were transcribed in Amharic language; translated to English and finally thematic analysis was done.

2.7. Operational definitions

Non-critical medical equipment: devices that touch either only intact skin or do not have direct contact with the patient [18]. In this study NCME indicates stethoscope, blood pressure apparatus, thermometer, pulse oximeter and glucometer.

Practiced: was considered when a nurse disinfects the NCME with approved disinfectants before or after physical contact with patients.

Not practiced: was considered when a nurse failed to disinfect the NCME with approved disinfectants before or after physical contact with patients.

2.8. Ethics approval

Ethical clearance was obtained from Debre Tabor University College of Health Sciences. Subsequently, permission was obtained from the hospital's administrative office and unit heads of the hospital. Consent for the interview was obtained from head nurses.

3. Results

3.1. Demographic characteristics

NCME cleaning practice of 137 nurses working in DTCSH was observed, which gives a response rate of 90.1%. About 66.4% of the participants were female, 75.2% encounters were observed in inpatient units, and 67.1% of encounters were observed during the day shift (Table 1).

3.2. Distributions of nurse's cleaning practice of NCME

During the study period, 1104 NCME cleaning opportunities were observed covertly. Covert observation was selected to get more valid data on nurses cleaning practice of NCME by avoiding social desirability behavior. About 274 opportunities for each of cleaning stethoscope, thermometer and blood pressure apparatus before or after patient contact were observed on 137 nurses working in inpatient and outpatient units. As pulse oximeter and glucometer are not available in all units, cleaning practice of this equipment of nurses working in these units could not be observed. For this reason, only 176 opportunities for cleaning pulse oximeter before or after patient contact and 106 opportunities of cleaning glucometer before or after determining blood glucose levels were noted on 88 and 53, nurses respectively. As shown in Table 2, vast majority of nurses did not clean routinely used non-critical medical equipment before and/or after patient examination. The highest percentage of practice observed was for cleaning thermometer after checking patients body temperature, which was 5.1%. None of them were observed cleaning blood pressure apparatus before or after checking patient's blood pressure and glucometer before determining blood glucose levels. None of them also cleaned an NCME both before and after patient encounter. From the total 1104 cleaning opportunities of NCME only 21 (1.9%) were practiced. Alcohol-based sanitizers were used in about 18 (85.7%) of the observed cleaning practices, whereas 70% alcohol was used in the other three practices (Table 2).

Table 1. Observation times, observation departments, and participants' gender at DTCSH, Debre-Tabor, Ethiopia, from July 5, to August 5, 2020 (N = 137).

Characteristics		Number	Percent (%)
Gender	Male	46	33.6
	Female	91	66.4
Working unit	Outpatient	34	24.8
	Inpatient	103	75.2
Working shift	Day	741	67.1
	Night	363	32.9

Table 2. Nurses' cleaning practice of non-critical medical equipment at DTCSH, Debre-Tabor, Ethiopia, from July 5, to August 5, 2020.

Item		Practiced	Not practiced	Total Opportunities
		N (%)	N (%)	N
Stethoscope	Before patient examination	4 (2.9)	133 (97.1)	137
	After patient examination	2 (1.5)	135 (98.5)	137
Thermometer	Before checking temperature	4 (2.9)	133 (97.1)	137
	After checking temperature	7 (5.1)	130 (94.9)	137
Blood pressure cuff	Before checking BP	0 (0.0)	137 (100.0)	137
	After checking BP	0 (0.0)	137 (100.0)	137
Pulse oximeter	Before measuring oxygen saturation	2 (2.3)	86 (97.7)	88
	After measuring oxygen saturation	1 (1.1)	87 (98.9)	88
Glucometer	Before determining blood glucose level	0 (0.0)	53 (100.0)	53
	After determining blood glucose level	1 (1.9)	52 (98.1)	53
Total Opportunities		21 (1.9)	1083 (98.1)	1104

3.3. Head nurses' response of availability of supplies, cleaning behaviors, and barriers to clean NCME

Findings of qualitative study were categorized into three thematic areas, which were the availability of supplies, perception of NCME cleaning practices in the unit and barriers to clean NCME. These three issues were repeatedly raised and stressed by head nurses. Head nurses reported that NCME are not adequately available. For instance, there were one to three stethoscopes, BP cuff, thermometer, and pulse oximeter in most units. Therefore, nurses need to share the same stethoscope and other equipment to assess patients. All head nurses replied that supplies needed for cleaning NCME as well as complying with other infection prevention methods are not available. They added that nurses in their working unit are performing below the standard, being exposed for health problems, and exposing their patients for infections. One participant nodding his head replied that:

"Personal protective equipment and materials needed to clean reusable equipment is not available. The problem is even worse during this pandemic. There is no clean glove; since surgical glove is expensive nurses are using the same pair of gloves to check vital signs of different patients; alcohol and sanitizers are not adequately available; even there are conditions when normal saline is used to clean intravenous cannulation site."

All head nurses perceived that NCME cleaning practice of nurses working in their unit was inadequate. Inpatient head nurses of the hospital reported that these devices were used to take vital signs of all admitted patients at least twice a day and during that time nurses mostly check vital signs without cleaning this equipment between patients. With regard to this one head nurse reported that:

"...disinfecting this equipment is vital. But, observing a nurse cleaning this equipment before or after patient assessment is rare. We even share the same stethoscope without cleaning the ear piece. We are therefore spreading microorganisms not only between patients but also between us."

The major barriers perceived by head nurses for inadequate cleaning of NCME were lack of supplies, lack of training, and negligence. Even though the lack of cleaning solutions is the main challenge, head nurses suggested that the lack of infection prevention training and commitment to clean used equipment to be contributing factors for inadequate reusable NCME safety. One head nurse expressed lack of supplies in this way:

"There is severe scarcity of solutions used for cleaning this equipment. Vital sign and other patient care equipment are not also sufficiently available. For instance, in this large ward with 42 beds we have only two stethoscopes, two blood pressure cuffs, one digital thermometer, one pulse oximeter and one glucometer. This equipment is being shared not only between patients but also between nurses. In this situation, it is difficult for me to blame nurses about their poor care of this equipment..."

4. Discussion

Proper disinfection of NCME between patient use is frequently neglected. This exposes these devices to be colonized by disease-causing microorganisms ultimately leading to health care-associated infections [11, 22, 23]. This study also found poor cleaning practice of stethoscopes, thermometers, BP cuffs, pulse oximeters, and glucometers among nurses working in DTCSH.

From a total of 274 stethoscope cleaning opportunities, 137 observed before and 137 after patient examination, only 6 opportunities were practiced. About 2.9% and 1.5% of stethoscope cleaning opportunities were practiced before and after patient encounter, respectively. This is in line with a study that found 2.8% before and 2.8% after non-critical stethoscope interactions [22]. Higher percentage of practice was reported from a study conducted in southwest Ethiopia that 22.5% HCWs disinfect their stethoscope. Only 6.45% of whom practice it persistently. This discrepancy with the current study might be due to the self-administered method of data collection used in that study [15].

Stethoscopes were found to be highly colonized by disease-causing microorganisms, which in turn contributed to health-care-associated infections [24]. Stethoscopes were suggested to contribute to nosocomial transmission of COVID-19. Stethoscope-associated COVID-19 may be caused from stethoscope contamination by the virus or close physical contact with infected patients [25]. Although it is not widely available, electronic stethoscope is easy to be done with personal protective equipment for COVID-19 and vital to keep physical distance with the patient than acoustic stethoscope. However, proper care remains vital for both types of stethoscopes [26].

About 2.9% and 5.1% of nurses disinfected thermometers before and after measuring body temperature, respectively. This percentage of practice is highly poor as per the recommendation and risks of contamination [18]. A research study in Ethiopia reported that 20.4% of physicians disinfect non-infrared thermometers after patient encounter. The inconsistency with the present study may be related to the method of data collection, which was an online survey and the study participants being physicians. In online survey respondents may tend to report a favorable practice, whereas in covert observation individuals are observed in natural surroundings which help to get more valid data [27].

Glucometers may become contaminated when measuring the blood glucose level. Bacterial contamination is high not only in glucometers but also in unused glucose test strips. For this reason, these devices deserve proper disinfection [28]. Nevertheless, only one (1.9%) of nurses included in this study cleaned glucometers after determining the blood glucose level.

None of the nurses participated in this study cleaned BP cuff before or after measuring BP. It may not be must to disinfect blood pressure apparatus before or after every patient encounter. However, observing that none of the BP apparatuses were getting disinfected clearly indicates a gap [18].

Head nurses also perceived inadequate cleaning practice of reusable NCME in their respective units. Inadequate cleaning practice of reusable NCME in turn contributes to contamination of these equipment by different microorganisms' majority of which are infectious to humans and resistant to drugs [29].

The major barrier for cleaning NCME perceived by head nurses was the lack of supplies needed for cleaning these devices. Head nurses also reported shortage of reusable NCME in their respective units. Sharing the same NCME between many individuals with inadequate cleaning between use makes the problem worse. Shortage of supplies needed to prevent and control COVID-19 was a critical issue during this pandemic [30]. Lack of training was also raised by head nurses as a barrier to cleaning NCME. Training obviously increases knowledge and compliance toward infection prevention recommendations [31]. It might also help nurses improve their NCME cleaning practice with the available resources.

5. Limitations

Nurses' cleaning practice of NCME was observed once. It would be better if nurses are being observed repeatedly. This study did not evaluate the condition of NCME. It is better if future studies observe nurses' practice repeatedly and include physical and laboratory investigation of these devices. Results of the study can only be generalized to this study group.

6. Conclusion

Nurses' cleaning practice of routinely used non critical medical equipment was very low. Some of the practices were totally neglected by all participants. Lack of disinfecting materials, lack of training on infection prevention, and negligence were perceived by head nurses as barriers for inadequate cleaning practices. Poor cleaning practice of non-critical medical equipment compromises patient safety. Therefore,

nurses need to get training on the care of routinely used non critical medical devices and other infection control measures. Proper supply of materials needed to clean these devices need to be also secured.

Declarations

Author contribution statement

Tekalign Amera and Abraham Tsedalu: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Sheganew Fetene, Tigabu Desie, Dejen Getaneh and Ermias Sisay: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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