Original Article

KNOWLEDGE AND PRACTICES ON USE OF MEDICAL TECHNOLOGICAL DEVICES AMONG NURSES IN SPECIALIZED HOSPITAL

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ABSTRACT

Background: Nurses are more involve handling medical technological devices which is essential for cardiac treatment. There has been no published systematic review which has examined nurses' Knowledge and practices on use of medical technological devices. To find out the level of Knowledge and practices on use of medical technological devices among nurses in specialized hospital.

Methods: A descriptive type of cross-sectional study was conducted from January to December 2023 at National Institute of Cardiovascular Diseases and Hospital (NICVD), Dhaka, Bangladesh. Pretested self-administered questionnaire with Knowledge score; out of 30 questions and practice score; out of 24 questions and observational checklist also used. Score value awarded for wrong answer (0) and correct answer (1). A total of 230 nurses who fulfill the inclusion criteria were selected from different unit of hospital by using simple random sampling techniques.

Result: The mean(±SD) age of the respondents was 35.45(±8.27) years. Among 230 respondents around one fifth of respondents had training and majority nurses did not receive any kind of training, consequently it was found that around one fourth of the respondents had low practice level and around one fifth nurses had extremely low knowledge. About one third nurses were used cleaners containing acetone to clean cardiac monitor. All over two third of respondents was correct practice on "Low Battery" warning of a defibrillator. The statistically significant associations were observed between both the duration of working experience in NICVD and the practice level ($p= 0.017$) Knowledge level ($p < 0.0001$) as well as the professional education and their practice level ($p < 0.0001$). A statistically significant correlations were found between knowledge and practice ($r =.461^{**}$, $p < 0.0001$). Mann-Whitney U Test indicate that training influenced on knowledge and practice ($p < 0.0001$).

Conclusion: Nurses need adequate training on medical technological devices that will enhance their practical skills.

JOPSOM 2023; 42(2): 12-17
https://doi.org/10.3329/jopsom.v42i2.77157

Key words: Knowledge; Practice; Medical technological devices; Mechanical Ventilator; ECG Machine; Defibrillator; Cardiac Monitor; CVP manometer; Temporary Pacemaker

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INTRODUCTION

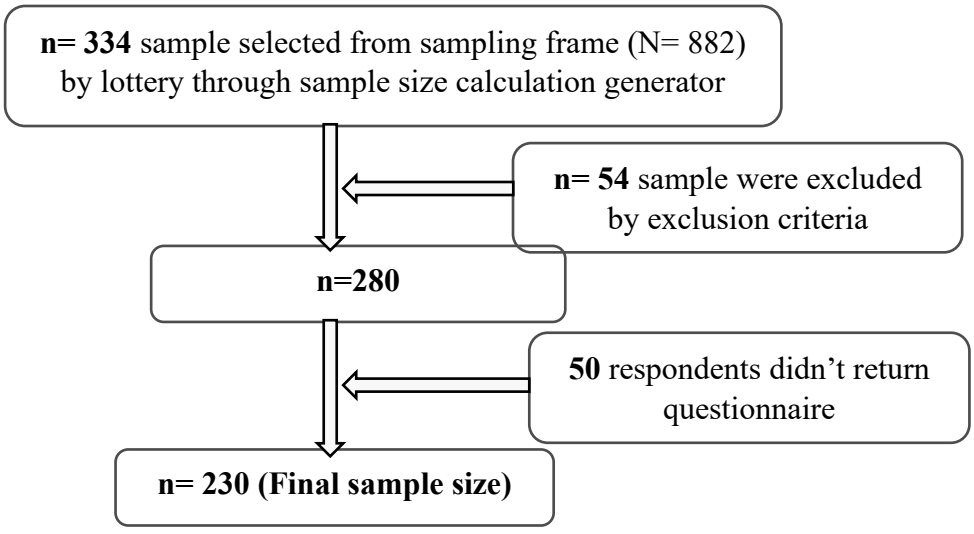
Medical technological devices in modern culture have advanced quickly since the creation and development of the microchip, having an impact on people's daily lives. In a hospital context, where technical advancements are continually improving, this is also readily apparent. Today's hospitals offer nursing care and medical equipment that dramatically improve the chances of survival for seriously ill patients. Technology is defined by Barnard (2000) as tools, machinery, and equipment-both new and old-connected to management and information in order to maximize efficiency. As the definition of medical-technical equipment, which is defined as equipment that would detect, prevent, monitor, treat, compensate for injury and impairment, or alleviate sickness.[1] Professional nurses in clinical practice are the principal users of medical devices at the point of care. They are confronted daily with devices used for patient monitoring, diagnostic testing, surgical and therapeutic interventions, and telemedicine. Over time, these devices have become increasingly complex and sophisticated, reshaping the delivery of healthcare both in the hospital and the home, and subsequently creating more challenges for nurses.[2]

The study's objective is to offer data for additional research on the effects of medical technology on nursing practice. Nurses are regularly exposed to new devices that need to be integrated into care delivery systems and have the professional responsibility for developing their competence in the use of these devices to ensure patient safety. Safe gadget uses in a healthcare setting that is becoming more technologically advanced while honoring nurses' professional identities and emphasizing the importance of compassionate patient care.[3] It is impossible to overestimate how dependent the health care sector is on medical technology, and thanks to the creation of these amazing innovations, medical professionals can always look for ways to improve their patient care, surgical techniques, and diagnosis. The general public thinks that technology will increase the cost, quality, safety, and efficiency of healthcare. Device-related issues are unavoidable since millions of healthcare providers use approximately 5,000 different types of medical devices worldwide. Technology carries some risks even though it can potentially improve care.[4]

Patients with implanted cardiac devices constitute a growing segment of contemporary health practice. Nurses have a unique role providing care in hospitals, long-term health care, education and psychological support to these patients. Over a period of 3 years in the critical care units at El-Manial University Hospital (the biggest teaching hospital in Egypt), empirical observation showed that patients' outcomes and self-care abilities. Knowledge and Practices on use of medical technological devices among nurses were influenced to some extent, and there was readmission of some patients suffering from different complications. Most of these complications were life-threatening yet preventable but were not documented. Nursing staff on general medical wards are not routinely offered training but may be the key to greater resuscitation success in hospitals. When on duty, these nurses are frequently involved in cardiac arrests, often as first responders. As the number of patients obtaining pacemakers, ICDs, and combination devices rises, interdisciplinary approaches are required to address these population-specific demands. By assisting patients and their families both during and after implantation, nurses with a holistic approach to patient care can significantly contribute to this.[5]

METHODS

The descriptive cross-sectional study was conducted among 230 nurses of National Institute of Cardiovascular Diseases and Hospital (NICVD), Dhaka, Bangladesh. Over a period of one year starting from 1st January 2023 to 31st December 2023.The sample were selected by simple random sampling technique by the following way:



The study started with literature review, then protocol presentation followed by permission from the Institutional Review Board (IRB) OF NIPSOM. After developing the questionnaire, pretesting of the questionnaire was carried out on 33 respondents working in several cardiac units of Bangladesh Shisu Hospital and Institute (BSHI), Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh. Data were collected by a pre-tested semi-structured self-administered questionnaire from the respondents who fulfill the selection criteria. The questionnaire was prepared by the following user manual of the medical technological devices which collected from NICVD; (Beneheart R3 Electrograph operator's manual, 2019)., (Pace model 101, 2021)., (ELPRO S.r.l, 2019)., (Cardiac monitor operator's manual, 2012)., (Inspiration mechanical ventilator user manual, 2016)., (CVP manometer user manual, 2012).

Data were collected from the nurses of NICVD. Questionnaire were supplied to the nurses and requested to fill up the questionnaire by themselves and after filling the questionnaires, these were collected from them. The purpose of the study was explained in detail to the respondents. If the respondents agreed to participate, then written consent form was explained prior to interview. Assurance was given regarding confidentiality and secrecy of the information they provided. Data had been compiled, coded, clear, categorized and edited according to objectives and variables. The statistical analysis was conducted using SPSS (Statistical Package for Social Science) version 27 statistical software. After ensured that there was no irrelevant data. Thus, the quality of the data was managed. Nurse's knowledge and practice, level has been analyzed with scoring system. Scoring system done by Out of 24 questions for practice and 30 questions for knowledge level, lowest value (0), highest value (24), correct answer (1), wrong answer (0). The analysis was carried out by using both descriptive and inferential statistics - chi square test, Spearman's rho correlation test Mann-Whitney U Test were done to find association.

Ethical Consideration

Ethical clearance for this study was obtained from the Institutional Review Board (IRB) of NIPSOM. Memo no: NIPSOM/IRB/2023/06

RESULTS

Out of 230 respondents, 51.7% were from 25-33 years age group, 25.2% were from 34-42 years age group, 17.8% were from 43-51 years age group while 5.2% were from 52-60 years age group. The mean age 35.45 (±8.277) years. Majority (96%) were female while 4% were male. 53% were diploma in nursing passed, 30% were B.S.C in nursing passed while 17.0% had completed Masters. 42.2% had monthly income 25000-36000 taka, 32.2% had monthly income 37000-48000 taka, and 9.6% had monthly income 49000-60000 taka while 16.1% had their monthly income 61000-70000 taka. The mean monthly income 41230.43 taka. 71.7% respondents had no work experience of others hospital cardiac unit while 28.3% had work experience of others hospital cardiac unit. 62.2% had working experience in CCU, 51.3% in ICU, 27.0% in OT while 17.0% had working experience in Cath lab. 22% had training and most of the nurses did not receive any training (Table-1).

Table 1. Distribution of respondents according to socio-demographic characteristics of the respondents (n=230).

Characteristics	Respondents	Percentage
Gender	Male	0.4
	Female	96
Age group(years)	25-33	51.7
	34-42	25.2
	43-51	17.8
	52-59	5.2
Mean age	35.45±8.3 years	
Professional Education	Diploma	53
	B.S.C in nursing	30
	Masters or above	17
Monthly income (BDT)	Tk.25000-36000	42.2
	Tk.37000-48000	32.2
	Tk.49000-60000	9.6
	Tk.61000-70000	16.1
Mean income (BDT)	Tk. 41230.43±12745.54	
Work experience in cardiac unit	Yes	71.7
	No	28.3
Work experience in special area	Coronary Care Unit (CCU)	62.2
	Intensive Care Unit (ICU)	51.3
	Operation Theatre (OT)	27.0
	Cath lab	17.0
Training	Yes	22
	No	78

Among the respondents 17.8% had training on defibrillator, 17.4% had training on mechanical ventilator, 17.0% had training on cardiac monitor, 15.7% had training on ECG machine, and 10.4% had training on CVP manometer while 9.6% had training on temporary pacemaker (Figure-1).

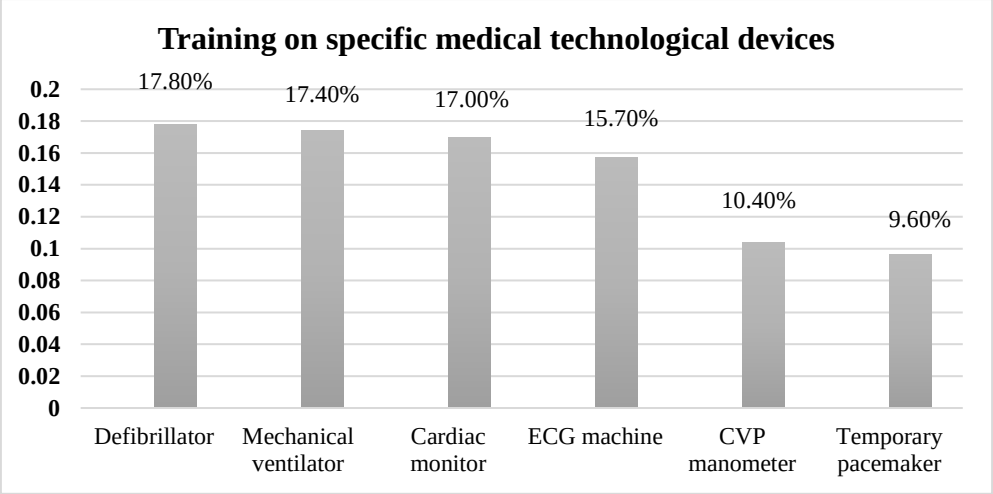


Figure 1. Training on specific medical technological devices

The study found overall knowledge level of participants on medical technological devices. Out of 230 respondents, about 27.4% had extremely low knowledge at 25 percentile and 30.0% had low knowledge at 50 percentiles on the other hand 21.3% had moderate knowledge at 75 percentile and 21.3% had high knowledge at 100 percentiles. Among 230 respondents 82 (35.7%) had extremely low practice at 25 percentile, 58 (25.2%) had low practice at 50 percentile, 49 (21.3%) had moderate practice at 75 percentile and 41 (17.8%) had high practice at 100 percentiles. (Table-2).

Table 2: Level of Knowledge & practice on medical technological devices

Knowledge level	**(%)**		**Practice level**	**(%)**	
Extremely low knowledge	27.4	Knowledge score Mean±SD 16.92±4.088, Median 17.00, Minimum 8, Maximum 25	Extremely low practice	35.7	Practice score Mean±SD 10.87±2.842, Median 11.00, Minimum 5, Maximum 19
Low knowledge	30.0		Low practice	25.2	
Moderate knowledge	21.3		Moderate practice	21.3	
High knowledge	21.3		High practice	17.8	
Total	**100.0**		**Total**	**100.0**	

Difference in the practice on the use of medical technological devices between those who received training and those who did not. Specifically, in terms of practice, the mean rank for those who received training (75.80) was significantly lower than for those without training (126.81), with a p-value of less than 0.0001. Specifically, in terms of knowledge, the mean rank for those who received training (69.53) was significantly lower than for those without training (128.60), with a p-value of less than 0. 0001. (Table-3).

Table 3. Difference between training with knowledge and practice on use of medical technological devices by Mann-Whitney U Test (n=230).

Attributes	**Findings**			
	Training scenario	Frequency	Mean Rank	Mann-Whitney U Test
Practices	Training	51	75.80	p<0.0001
	No training	179	126.81	
Knowledge	Training	51	69.53	p<0.0001
	No training	179	128.6	

Association between the age group of respondents and knowledge level on medical technological devices might be statistically significant (p <0.0001). Duration of working experience in NICVD and knowledge level might be statistically significant (p<0.0001). Association between the working

experience of others hospital cardiac unit and knowledge level might be statistically significant (p < 0.05). Association between the professional education and knowledge level might be statistically significant (p< 0.0001). Association between the age group of respondents and practice level on medical technological devices might be statistically significant (p <0.0001). Association between the duration of working experience in NICVD and practice level might be statistically significant (p=0.017). Association between the working experience of others hospital cardiac unit and practice level might be statistically significant (p < 0.05). Association between the professional education and practice level on medical technological devices might be statistically significant (p < 0.0001) (Table-4).

Table 4. Association between the level of practice on use of medical technological devices and Socio demographic characteristics of the respondents by Chi square (x^2) test (n=230)

Socio-Demographic characteristics	Chi square (x^2), df =3	
	Knowledge level	Practice level
Age group of respondents	x^2=33.8 p<0.0001	x^2=20.7 p<0.0001
Duration of working experience in NICVD	x^2=22.8 p<0.0001	x^2=10.1 p= 0.017
Working experience of others hospital cardiac unit	x^2= 9.687 p= 0.021	x^2= 6.0 p= 0.111
Professional education of the respondents	x^2=36.2 p<0.0001	x^2=18.3 p<0.0001

Correlation between practice and knowledge, correlation coefficient, r was (.461**), both was statistically significant (p<0.0001). So, there was a moderate positive correlation between practice with knowledge on use of medical technological devices (Table-5).

Table 5: Correlation between practice with knowledge on use of medical technological devices by Spearman's correlation (n =230)

Correlation	Spearman's rho correlation coefficient	Significance
Practice and Knowledge	.461**	<0.0001

DISCUSSION

Nurses wholly and solely responsible for the patient who was admitted in the hospital as well as community. The present study was conducted to assess the level of knowledge and practice among nurses on use of medical technological devices in specialized hospital, Dhaka, Bangladesh. In order to achieve the objectives of the study a descriptive cross-sectional study was adopted by sample random sampling techniques. The mean age of respondents was 35.45(±8.27) years. The mean of the respondents was higher than other studies [3, 10] as the present study had nurses with 25 years of age at lower limit. Majority (96%) were female while (4%) were male. In Bangladesh, percentages of female nurse's recruitment are more compared to male. This might be the reason of more female providers in the current study. The result was consistent with others study.[6] Majority 68 (30%) were B.S.C in nursing passed, (53%) respondents were diploma in nursing passed, while 39 (17.0%) had completed master's in nursing. Which is lower than others study.[7]

In the study majority 102 (44.3%) had duration of work experience from 1-7 years, 74 (32.2%) had duration of work experience from 8-14 years, 20 (8.7%) had duration of work experience from 15-21 years while 34 (14.8%) had duration of work experience from 22-26 years. Mean±SD 7.97±6.5 years, which is similar result were found in others study.[5] Among 230 respondents, only 51 (22%) had training on medical technological devices, whereas 179 (78%) had no training on medical technological devices. Which is so much lower than others study.[5-7] Among 230 respondents 197 (85.7%) respondents had knowledge on experience to handle mechanical ventilator, 219 (95.2%) had knowledge on experience to handle cardiac monitor, 184 (80.0%) respondents had knowledge on experience to handle defibrillator, 194 (84.3%) had knowledge on experience to handle temporary pacemaker, 182 (79.1%) had knowledge on experience to handle CVP manometer while 224 (97.7%) had knowledge on experience to handle ECG machine. Another study showed that the number of studies investigating the use of health technology and their thought on technology is insufficient.[6] Present study

found that overall knowledge level on medical technological devices. Out of 230 respondents, about 63 (27.4%) had extremely low knowledge at 25 percentile and 69 (30.0%) had low knowledge at 50 percentiles on the other hand 49 (21.3%) had moderate knowledge at 75 percentile and 49 (21.3%) had high knowledge at 100 percentiles. It was found that 82.5% of the studied nurses had got unsatisfactory level of knowledge regarding ECG interpretation and criteria of normal sinus rhythm.[5] Among the 230 respondents' overall level of practice on medical technological devices, among the respondents 82 (35.7%) had extremely low practice at 25 percentiles, 58 (25.2%) had low practice at 50 percentiles, 49 (21.3%) had moderate practice at 75 percentiles and 41 (17.8%) had high practice at 100 percentiles. Another study revealed the educational level and work experience of nurses were significantly associated with the practice of nurses Based on a recent data in Pakistan, Unsatisfactory nursing care practices result in irreparable complications for approximately 28% to 35% of patients. Because untrained critical care nurses oversee more than 90% of Pakistan's critical care units.[7]

In self-administered questionnaire 90.4% respondents stated that they practice hand hygiene before and after use any medical technological devices but when I observed their practice by observational checklist then I noticed that they were not maintain hand hygiene properly before and after use of any technological devices. Nurses had no practice on medical technological devices. Nurses need to improve practical skills through learning process to maintain competence.

CONCLUSION

From this study it is concluded that majority nurses work experience in NICVD hospital less than seven years and maximum nurses was only concept about medical technological devices, from the selected device, such as- mechanical ventilator, defibrillator, ECG machine, cardiac monitor, CVP manometer, Temporary pacemaker. Most of the participants had work experience of fewer than seven years, and among them, there were more diploma holders. More than one third nurses had no knowledge on importance of documentation to prepare medical technological devices. Only ten percent nurses read manufacturer's instructions before cleaning the CVP manometer. Nurses' response during alarm of mechanical ventilator, which was maximum incorrect. There was a positive correlation between knowledge and practice on use of medical technological devices. Duration of working experience play crucial roles in influencing on knowledge and practice regarding the use of medical technological devices. A significant conclusion of the current study revealed that many nurses did not receive any kind of training on medical technological devices, while a small percentage did receive it. Which can later act as a major barrier behind not improving their knowledge and practice level.

DECLARATION

Competing interests: All the authors declared no competing interests.

Funding: This study did not receive any grants.

ACKNOWLEDGEMENTS

The authors are thankful to all the participants for their heartfelt cooperation.

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