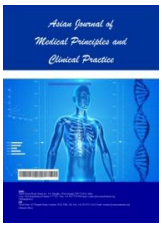

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Knowledge of Pressure Ulcer and Its Preventive Measures among Nurses in Madonna University, Rivers State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors UMJU and SCU conceived this study. Authors TMA, FI and FUO contributed to the drafting and critical review of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aim: The study aimed to ascertain the level of knowledge of Pressure Ulcers (PU) and their preventive measures among Nurses in Madonna University Teaching Hospital, Rivers State, Nigeria.
Study Design: A descriptive survey research design was used.
Methodology: The sample of the study comprised 100 Nurses of the various units in the hospital. A structured questionnaire was the main instrument used for data collection. Face validity was employed. The reliability of the instrument was established using the test-retest method in which the questionnaire was administered to twenty health workers in the Federal Medical Center, Owerri, Nigeria. The results were analyzed using Pearson's Product Moment. The reliability coefficient was 0.75, which indicated that the instrument was reliable.
Results: The frequency and percentages showed that higher educational qualification (81%, 91.4%) and longer work experience (88.8%, 88.9%) improved PU knowledge and PU prevention knowledge respectively. The study tested for associations between PU knowledge with educational

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qualification; and work experience. There were no significant associations between educational qualification with PU knowledge (χ^2=.51, *P*=.77) and PU prevention knowledge (χ^2=2.39, *P*=.30). There were no significant associations between work experience with PU knowledge (χ^2=1.205, *P*=.75) and PU prevention knowledge (χ^2=5.43, *P*=.67).

Conclusions: The majority of the nurses of MUTH have a high level of overall knowledge regarding PU but a good number of lack knowledge in some areas such as massage over bony prominences being a trigger to PU. Refresher courses and training programs on PU prevention should be organized for nurses to keep them up to date.

Keywords: Pressure ulcer; prevention; nurses; education; midwives; gender.

1. INTRODUCTION

Pressure ulcers (PU) are the common conditions that occur among patients who have been hospitalized in acute and chronic care facilities globally [1]. They are regarded as areas of localized injury to the skin, underlying tissues, or both [2]. They are recognized globally as one of the five most common causes of harm to patients and described as one of the most costly and physiologically-incriminating conditions of the 20th century [1]. It still lingers as a persistent issue and occurs in all health care settings while affecting all age groups, but prominently among the elderly [3]. It has caused great financial burdens for families and loved ones while it also poses serious threats to a patient's quality of life [1,3]. The pains and discomfort that come with PU are envisaged as indications of poor practices of its prevention hence creating a need for PU to be regarded as a priority in clinical and non-clinical settings [4]. This condition delays rehabilitation, prolongs morbidity, causes disabilities, and ultimately leads to the death of a patient [1]. These resultant effects dramatically raise health care costs as a result of the need for more human resources for health and more work hours [5]. Consequently, many countries spend billions of dollars on prevention and therapy for persons with prolonged hospital stays from the development of PU [2]. For example, Uba et al. [2] reported that PU remains a major health problem that affects up to 3 million adults.

Many studies have found poorly demonstrated preventive practices against PU among nurses [6] which have been attributed to barriers such as poor knowledge of guidelines in clinical practice, shortage of staff, lack of time [7], satisfaction with nursing leadership, inadequate facilities, and equipment [1]. Strand and Lindgren [8] found that the incidence of PU may vary between 1 and 56% in intensive care units of hospitals and this may increase as a result of failure to address these barriers. These poor demonstrated preventive practices have further worsened the situation as Gorecki et al. [9] found that PU significantly affects the physical, social, financial, and mental quality of life of the patients.

PU prevention is a key function of various clinical settings in modern times. According to Samuriwo [10], recent studies have shown that nurses place less value on PU prevention. Also, Gill and Moore [11] found low levels of knowledge among nurses that led to poor PU prevention practices. Moore [12] also recognized that the poor strategic planning and failure of nurses to put theory into practice was a function of their poor knowledge of PU. Also, a Belgian study found that the knowledge of nurses on PU was low [13]. Evidence-based guidelines for PU prevention exist and are available for use in all clinical settings [14]. Emphases are being placed on the nurses because although PU is a multi-disciplinary affair, the nurses and midwives play the major roles in taking care of patients in the health care facility.

In Nigeria and other developing countries, the evidence is lacking in nurses' knowledge of prevention practices against PU. Accordingly, this study aimed to assess the general knowledge of PU as well as the knowledge of the preventive practices against PU among nurses to generate significant information to inform policy programing and improve general PU interventions.

2. MATERIALS AND METHODS

2.1 Study Design

For the achievement of the objectives of the study, a descriptive survey design was used. A descriptive survey design is a type of research design that allows anonymous access into the thought processes and behaviors of a target group of people by asking them to report the information themselves.

2.2 Study Area

This study was carried out at Madonna University Teaching Hospital (MUTH), Elele, Rivers state. The hospital was founded in 1999. They offer a wide range of medical services and have many departments namely: Medical and Surgical ward, pediatric units, obstetrics, and the gynecological unit, accident and emergency unit, and the outpatient department which includes General Out-Patient Department (GOPD), dental clinic, eye clinic, immunization, and antenatal.

2.3 Study Population

The population of the study was made up of nurses in the male and female medical wards and units. The overall population in these units was 100 at the time of the study.

2.4 Sampling and Sampling Techniques

Since the population of the study was 100 nurses at the time of this study, the researchers used all the staff as respondents.

2.5 Instruments for Data Collection

The instrument used was a structured questionnaire developed by the researcher. Section A consisted of the socio-demographic data of the respondents such as gender, working experience (as per number of years as a nurse), and educational qualification. Section B examined the nurses' knowledge of pressure ulcer development and consisted of 8-item/statements which were modified and developed from the universally accepted National Pressure Ulcer Advisory Panels guideline (NPUAP 2009). These 8 questions sought to ascertain the general knowledge of PU among the respondents. All the items were patterned on a 2 point scale of 'yes or No'. Section C examined the nurses' knowledge of the preventive measures of pressure ulcers. It consisted of 14 items/statements; all the items were patterned in a 2 point scale of 'Aware' or 'Unaware'.

2.6 Validity of Instruments

The questionnaires were face validated by 3 independent validators from the Department of Public Health, Madonna University, Nigeria. They examined the work critically, made possible corrections, and returned to the researchers. The validators were requested to ascertain the appropriateness of the content of the questionnaire in line with the objectives of the study. Modifications were made based on the validators' comments and the original copy of the instruments was published.

2.7 Reliability of Data Collection

The reliability of the instrument was established using the test-retest method in which the questionnaire was administered to twenty health workers in the Federal Medical Center, Owerri, Nigeria. The results were analyzed using Pearson's Product Moment. The reliability coefficient was 0.75, which indicated that the instrument was reliable.

2.8 Method of Data Collection

A letter of introduction signed by the Head, Department of Public Health was presented to the Director-General of Nursing services (DGNS) of MUTH to seek the permission which was granted. All the necessary information was given to the researchers through a letter of permission signed by the DGNS. The self-administered valid and reliable self-structured questionnaire was distributed to the respondents on a face-to-face basis by the researchers and the collection of data was made possible immediately after administration. The distribution and collection of the questionnaire were done in one day because some of the nurses were transferred from one unit to another on daily intervals (Morning and night duty). The researcher explained the purpose of the research to the nurses individually.

2.9 Method of Data Analysis

The results were presented using descriptive statistics and inferential statistics. The level of significance was placed at .05. Appropriate degrees of freedom were worked out and used for readings. Out of one hundred copies of the questionnaire distributed, all one hundred (100%) were returned and used for data analysis. The results of the data analyses are presented in line with the research questions posed.

3. RESULTS

Table 1 shows that there were 14% male respondents and 86% female respondents. Also, 19% of the respondents had attained a Registered Nurse (R/N) qualification, 23% had

attained Registered Midwife (R/M), and most respondents (58%) had attained a Bachelor of Nursing Science (BSN).

Data from Table 2 show that there were generally high levels of knowledge of PU among the respondents regardless of their educational qualifications. The highest knowledge level of PU (81%) was recorded among those with BSN qualification, while those with R/M qualification had the least knowledge level (73.9%) of PU.

Table 3 showed that respondents with greater than 15 years of nursing experience had the highest knowledge of PU (88.8%) while those with 1-5 years of nursing experience had the least knowledge level (66%) of PU.

Table 1. Sociodemographic characteristics of respondents

Variables	Frequency (n=100)	Percent (%)
Gender		
Male	14	14
Female	86	86
Educational Qualifications		
Registered Nurse (R/N)	19	19
Registered Midwife (R/M)	23	23
Bachelor of Nursing Sciences	58	58
Work experience		
1-5 years	52	52
6-10 years	23	23
11-15 years	6	6
>15 years	9	9

Table 2. Frequency and percentage of knowledge of PU among Nurses in MUTH based on their educational qualifications (n= 100)

Educational qualifications

S/N	Items	R/N n= 19		R/M n=23		BSc/BSN n=58	
		Yes f(%)	No f(%)	Yes f(%)	No f(%)	Yes f(%)	No f(%)
1.	Item 1	19(100)	0(0)	22(95.7)	1(4.3)	58(100)	0(0)
2.	Item 2	16(84.2)	3(15.8)	18(78.3)	5(21.7)	57(98.3)	1(1.7)
3.	Item 3	9(47.4)	10(52.6)	12(52.2)	11(47.8)	32(60.3)	26(44.8)
4.	Item 4	10(52.6)	9(47.4)	15(65.2)	8(34.8)	32(60.3)	26(44.8)
5.	Item 5	17(89.5)	2(10,5)	17(73.9)	6(26.1)	45(77.6)	13(22.4)
6.	Item 6	19(100)	0(0)	22(95.7)	1(4.3)	57(98.3)	1(1.7)
7.	Item 7	14(73.5)	5(26.3)	15(65.2)	8(34.8)	55(94.8)	3(5.2)
8.	Item 8	13(68.4)	6(31.6)	16(69.6)	7(30.4)	39(67.2)	19(32.8)
Average		15	4	17	6	47	11
%Average		78.9	21.1	73.9	26.1	81	19

**Keys*

R/N= Registered Nurse who has only attended a School of Nursing and obtained an associate degree

R/M= Registered Midwife who has only attended a School of Nursing/Midwifery and obtained an associate degree

BSN= Bachelors degree of Science in Nursing: Has attended a University, done a 4-5 years program, and obtained bachelor's degree.

Item 1= P.U is a localized skin breakdown that leads to tissue damage?

Item 2= P.U usually occur over bony prominences?

Item 3= Intact skin with non-blanchable redness is a sign of stage ii P.U?

Item 4= A shallow open ulcer with a pink wound bed is a sign of stage ii P.U?

Item 5= Age is a risk factor of P.U?

Item 6= Immobility is a risk factor of P.U?

Item 7= Dragging a patient up a bed can cause P.U?

Item 8= Massage over bony prominences can cause P.U?

Table 3. Frequency and percentage of knowledge of PU among nurses in MUTH based on their work experience

S/N	Items	1-5years (n=52)		6-10years (n=23)		11-15years (n=16)		>15 (n=9)	
		Yes f(%)	No f(%)	Yes f(%)	No f(%)	Yes f(%)	No f(%)	Yes f(%)	No f(%)
1.	Item 1	40(77)	12(23)	23(100)	0(0)	15(93.8)	1(6.3)	9(100)	0(0)
2.	Item 2	40(77)	12(23)	20(87)	3(13)	13(81.3)	3(18..8)	9(100)	0(0)
3.	Item 3	25(48.1)	27(51.9)	13(56.5)	10(43.4)	11(68.8)	5(31.3)	4(44.4)	5(55.6)
4.	Item 4	31(59.6)	21(40.4)	10(43.5)	13(56.5)	10(62.5)	6(37.5)	6(66.7)	3(33.3)
5.	Item 5	43(82.7)	9(17.3)	14(60.9)	9(17.3)	13(81.3)	3(18.8)	9(100)	0(0)
6.	Item 6	15(29)	23(71)	21(91.3)	2(8.7)	16(100)	0(0)	9(100)	0(0)
7.	Item 7	46(88.5)	6(11.5)	17(73.9)	6(26.1)	12(75)	4(25)	9(100)	0(0)
8.	Item 8	34(65.4)	18(34.6)	19(82.6)	4(17.4)	8(50)	8(50)	7(77.8)	2(22.2)
	Average	37	15	17	6	12	4	8	1
	%Average	66	34	73.9	26.1	75	25	88.8	11.1

Table 4 shows data on the knowledge of preventive measures against PU among the study population based on their educational qualifications. The data shows that those with BSN had the highest knowledge level of the preventive measures against PU (91.4%) while those with R/N qualification had the least knowledge levels (78.9%) of preventive measures against PU.

Table 5 presents data on the knowledge of preventive measures against PU based on work experience among the study population. Respondents with greater than 15 years' work experience had better overall knowledge (88.9%) of preventive measures against PU while those with 1-5 years working experience recorded the least level of knowledge of preventive measures against PU.

The study also tested hypotheses. The first hypothesis was stated thus: There is no significant difference in the level of knowledge of PU among nurses in MUTH based on their educational qualification. Table 6 shows the data to test this association. At 0.05 level of significance 2 degrees of freedom and $\chi^2 =$ 0.51, we failed to reject the null hypothesis (*P*= .77). This means that there is no significant difference in the knowledge of PU among nurses in MUTH based on their educational qualifications.

Table 4. Frequency and percentage of knowledge of preventive measures against PU among nurses in MUTH based on their educational qualifications (n=100)

s/n	Items	R/N n=19		R/M n=23		BSN n=58	
		Aw F(%)	Unw F(%)	Aw F(%)	Unw F(%)	Aw F(%)	Unw F(%)
1.	Item 9	16(84.2)	3(15.7)	22(95.7)	1(4.3)	54(93.1)	4(6.9)
2.	Item 10	17(89.5)	2(8.7)	21(91.3)	2(10.5)	53(91.4)	5(8.6)
3.	Item 11	15(78.9)	4(21.1)	22(95.7)	1(4.3)	54(93.1)	4(6.9)
4.	Item 12	18(94.7)	1(5.3)	22(95.7)	1(4.3)	57(98.3)	1(1.7)
5.	Item 13	18(94.7)	1(5.3)	22(95.7)	1(4.3)	57(98.3)	1(1.7)
6.	Item 14	15(78.9)	4(21.1)	21(91.3)	2(10.5)	51(87.9)	7(12.1)
7.	Item 15	16(84.2)	3(15.7)	22(95.7)	1(4.3)	55(94.8)	3(5.2)
8.	Item 16	16(84.2)	3(15.7)	20(87)	3(13.1)	55(94.8)	3(5.2)
9.	Item 17	17(89.5)	2(8.7)	22(95.7)	1(4.3)	55(94.8)	3(5.2)
10.	Item 18	14(73.7)	5(26.3)	22(95.7)	1(4.3)	37(63.8)	21(36.2)
11.	Item 19	7(36.8)	12(63.2)	12(52.2)	11(47.8)	37(63.8)	21(36.2)
	Average	15	4	21	2	53	5
	%Average	78.9	21.1	91.3	8.7	91.4	8.6

**Keys*

F = frequency

Aw/Unw = aware / unaware

Item 9 = P.U can be prevented in high-risk individuals through regular skin assessment.

Item 10 = Using pressure mattresses instead of standard bed impacts on the prevention of P.U.

Item 11 = use air rings pillows made of foam, air prevents P.U.

Item12 = Repositioning a bedridden patient helps in preventing P.U.

Item 13 = adequate diet helps prevent P.U.

Item 14 = Pressure supporting devices like mattresses with an alternating pressure overlay can be used in P.U prevention.

Item 15 = Turning patients' position every 2hrs is a significant nursing care activity in P.U prevention.

Item 16 = Placing a pillow under the patient's leg prevents P.U formation in heels.

Item 17 = Lifting an old man without dragging is an appropriate activity to reduce friction if he has a fractured hip.

Item 18 = Massage at bony prominences is an appropriate method for skincare in P.U prevention.

Item 19 = Applying topical cream is an appropriate method for skincare in P.U.

Table 5. Frequency and percentage of knowledge of preventive measures against PU among nurses in MUTH based on their work experience (n=100)

S/N	Items	1-5years (n=52)		6-10years (n=23)		11-15years (n=16)		>15 years (n=9)	
		Aw f(%)	Unw f(%)	Aw f(%)	Unw f(%)	Aw f(%)	Unw f(%)	Aw f(%)	Unw f(%)
1.	Item 9	35(67.3)	17(32.7)	23(100)	0(0)	16(100)	0(0)	9(100)	0(0)
2.	Item 10	35(67.3)	17(32.7)	20(87)	3(13)	14(87.5)	2(12.5)	9(100)	0(0)
3.	Item 11	30(58)	22(42)	19(82.6)	4(17.4)	15(93.8)	1(6.3)	8(89)	1(11.1)
4.	Item 12	39(75)	13(25)	20(87)	3(13)	16(100)	0(0)	9(100)	0(0)
5.	Item 13	35(67.3)	17(32.7)	23(100)	0(0)	16(100)	3(18.8)	9(100)	0(0)
6.	Item 14	35(67.3)	17(32.7)	18(78.2)	5(21.7)	15(93.8)	1(6.3)	8(89)	1(11.1)
7.	Item 15	39(75)	13(25)	19(82.6)	4(17.4)	16(100)	0(0)	9(100)	0(0)
8.	Item 16	33(63.5)	19(36.5)	20(87)	3(13)	15(93.8)	1(6.3)	8(89)	1(11.1)
9	Item 17	31(60)	21(40)	20(87)	3(13)	16(100)	0(0)	9(100)	0(0)
10									
11	Item 18	32(62)	20(38)	19(82.6)	4(17.4)	3(81.3)	3(18.8)	8(89)	1(11.1)
	Item 19	33(63.5)	19(36.5)	9(39.1)	14(60.9)	6(37.5)	10(62.5)	6(66.7)	3(33.3)
	Average	34.3	17.7	19	4	14	2	8	1
	%Average	66	34	82.6	17.4	87.5	12.5	88.9	11.1

Table 7 shows data on the test of association between knowledge of PU and respondents' work experience. The hypothesis was stated thus: There is no significant difference in the level of knowledge of PU among nurses in MUTH based on their working experience. At 0.05 level of significance 2 degrees of freedom and χ^2 = 1.205, we failed to reject the null hypothesis.

A third hypothesis was stated thus: There is no significant difference in the level of knowledge of the preventive measures against PU among nurses in MUTH based on their educational qualifications. Table 8 shows the association between respondents' knowledge scores of preventive measures against PU and educational qualifications. With *P*= .30, df= 2, and χ^2= 2.39, we failed to reject the null hypothesis.

Table 9 shows the results of observed and expected values of the hypothesis stated thus: There is no significant difference in the level of knowledge of the preventive measures against PU among nurses in MUTH based on their working experience. With *P*= .67, df= 2, and χ^2= 5.43, we fail to reject the null hypothesis.

Table 6. The association between respondents' knowledge scores of PU and their educational qualifications

Educational qualification	Yes	No	Chi-square (χ^2)	P-value
R/N	15(78.9%)	4(21.1%)		
R/M	17(73.9%)	6(26.1%)	0.51	0.77
BSN	47(81)	11(19%)		

Table 7. The association between respondents' knowledge scores of PU and their work experience

Work experience	Yes	No	Chi-square (χ^2)	P-value
1-5 years	37(66%)	15(34%)		
6-10 years	17(73.9%)	6(26.1%)	1.205	0.75
11-15 years	12(75%)	4(25%)		
>15 years	8(88.8%)	1(11.1%)		

Table 8. The association between respondents' knowledge scores on preventive measures against PU and their educational qualifications

Educational qualification	Aware	Unaware	Chi-square (χ^2)	P-value
R/N	15(78.9%)	4(21.1%)		
R/M	21(91.3%)	2(8.7%)	2.39	0.30
BSN	53(91.4)	5(8.6%)		

Table 9. The association between respondents' knowledge scores on preventive measures against PU and their work experience

Work experience	Aware	Unaware	Chi-square (χ^2)	P-value
1-5 years	37(66%)	15(34%)		
6-10 years	17(73.9%)	6(26.1%)	5.43	0.67
11-15 years	12(75%)	4(25%)		
>15 years	8(88.8%)	1(11.1%)		

4. DISCUSSION

The study assessed the knowledge of PU and preventive practices among nurses in MUTH. The study also tested 4 hypotheses. These hypotheses focused on 2 variables namely: educational level and work experience. There were a higher number of females (*n*= 86) than male respondents (*n*= 14) in the study because the study area had more female nurses than male nurses. In general, however, there were high levels of knowledge of PU and its preventive measures by the respondents. This is supported by findings of Pancorbo-Hidalgo et al. [15] who found that the prevention knowledge of nurses in a Spanish hospital was 79.1%. This high level of knowledge could be attributed to the various involvements of nurses and midwives in research projects, other capacity building programs, and practical sessions in the course of their education. In contrast to this, Strand and Lingren [8] found that nursing staff and enrolled nurses in a Swedish hospital had significantly less knowledge of PU which was evident in their wrong categorization of PUs. Correct categorization of PUs was made by only 46.8% of the nursing staff. Poor knowledge of the preventive measures against PU (73%) was also found among nurses in a Jordanian study [3]. These disparities can be attributed to the level and caliber of training different countries provide for their nurses and midwives.

Frequency and percentages showed that the nurses who attained higher educational qualifications (BSN) were more knowledgeable about PU. Pancorbo-Hidalgo et al. [15] also found this to be true. On the other hand, a test of significant associations in this study found no significant associations between knowledge of PU and educational qualifications. This is in contrast with a study by Nuru et al. [1] who found educational status (AOR =2.4, 95% CI) was significantly associated with knowledge on prevention of PU. Again, disparities in findings of significant associations between educational qualification and knowledge of PU could be attributed to the levels of formal training and the included topics in each curriculum of the nursing schools in different regions of the world. This is to say that some regions may incorporate a full curriculum of nursing practice regardless of the level, class or grade, whereas some regions may not.

Furthermore, although frequency and percentages showed that those with higher work experiences had better knowledge of PU and knowledge of its preventive measures, there were no significant differences between knowledge of PU and its preventive measures with the work experience of the respondents. This contrasts with findings by Nuru et al. [1] who found that work experience (AOR= 4.8, 95% CI) was significantly associated with knowledge of prevention of PU. Another study by Uba et al. [2] contrasted the findings from this study and found a significant relationship between the nurses' work experience and their practices of PU prevention. This could be attributed to the fact that many nursing and midwifery schools in modern times have incorporated modern, in-depth learning of some of the implications of longer bed hours for patients. Because of their involvement in modern trainings and practicums, nurses and midwives are exposed early to this concept and thereby practice it regardless of their work experiences.

This study had limitations. The main limitation was that the response of the various nurses might not reflect actual nursing practice as the study did not extend into their practice of the preventive measures of PU. The generalizability of the findings is another limitation, since the research was conducted in one hospital. The results might not conform to results from other hospitals.

5. CONCLUSION

Based on the findings of the study, the majority of the nurses of MUTH have a high level of overall knowledge regarding the preventive measures against PU. But an equally good number of them did not know that applying topical cream can prevent PU according to the recently updated NPUAP guidelines. Nurses of MUTH of various educational qualifications had a high level of overall knowledge regarding PU. All nurses in MUTH had a high level of overall knowledge of PU; regardless of their work experience although nurses with the highest level of knowledge were those with the longest duration of working experience.

Although frequency and percentages showed that those with higher educational qualifications and work experiences had better all-around knowledge of PU, hypotheses showed that there were no significant differences between these variables. This may have been as a result of the overall high knowledge of PU regardless of educational qualifications and work experiences.

However, the majority of the nurses of MUTH had a general high level of knowledge regarding PU but a good number of them lacked knowledge that massage over bony prominences can cause PU according to the recently updated NPUAP guidelines, hence a key finding of this study.

By implication, if the nurses' high knowledge is put into practice, it will go a long way in reducing the prevalence of PU which is on the rise around the globe.

6. RECOMMENDATIONS

- Refresher courses and training programs on PU prevention should be organized for nurses to keep them up to date.
- Nurses should put their knowledge of PU into practice to reduce the rising incidence of PU in the country.
- Hospital policies and guidelines are essential to ensure the nurses put their knowledge into practice
- A replication study is recommended in other settings to promote the generalizability of the findings above.

CONSENT AND ETHICAL APPROVAL

Permission was obtained from the director of nursing services at the hospital after explaining the purpose of the study to them. Consents were also obtained from the participants after an explanation.

DECLARATIONS

This research was approved by the Ethics and Research Committee of the Department of Public Health, Madonna University, Nigeria. It was further approved by the DG of Nursing Services in MUTH. All the necessary information was given to the researchers through a letter of permission signed by the DGNS.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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