Educational Intervention Effect on Nurses' Knowledge of Glasgow Coma Scale for Neurological Patient Assessment in Tertiary Hospitals in Edo State, Nigeria

Timothy A. Ehwarieme[1], Roselynd E. Esewe[2], Anwuli Emina[3]

[1]Department of Nursing Science, School of Basic Medical Science, University of Benin, Edo State, Nigeria.
e-mail: timothy.ehwarieme@uniben.edu
[2]Department of Nursing Science, School of Basic Medical Science, University of Benin Benin City Edo State Nigeria.
e-mail: roseline.esewe@uniben.edu
[3]Department of Nursing Science, Faculty of Basic Medical and Health Sciences, Behson Idahosa University, Benin City, Edo State, Nigeria.
e-mail:aemina@biu.edu.ng

Received March 23, 2024, accepted April 13, 2024, Published July 1, 2024.

ABSTRACT

Context: Nigeria reports increasing cases of neurological patients requiring close monitoring using the Glasgow Coma Scale (GCS). Although nurses are key health personnel managing these patients, evidence suggests they lack knowledge of the GCS and neurological assessment.

Aim: This study assessed the effect of an educational intervention on nurses' knowledge of GCS for neurological patients' assessment in selected tertiary hospitals in Edo State, Nigeria.

Methods: This is a quasi-experimental, non-equivalent control group, pre-post-test research design. The sample consisted of 98 nurses purposely selected from the neurological wards of the selected hospitals. A researcher-developed self-report questionnaire with a reliability Cronbach's alpha index of 0.832. Data analysis used descriptive and inferential statistics at the 5% significance level.

Results: Knowledge of GCS increased from a (0%) pre-test to 29(60.4%) very good knowledge level post-test one and 15(31.3%) post-test two, whereas the control group had 0% throughout the three periods. Significant differences (p 0.000) over the assessment times were found in the intervention group. The post hoc test revealed statistically significant differences between pre-test versus post-test one/and post-test two. A chi-square analysis of association showed no association between socio-demographic characteristics and level of knowledge on GCS among participants pre and post-intervention for both study groups (p>0.05).

Conclusion: This study has convincingly demonstrated the effectiveness of the developed educational intervention package in improving nurses' knowledge of the GCS. The self-instructional format offers an appealing approach to promoting self-directed learning among nurses. This approach can empower nurses to confidently assess patients using the GCS, interpret scores accurately, and apply their knowledge in clinical practice.

Keywords: Educational intervention, effect, Glasgow Coma Scale, knowledge, nurses

Citation: *Ehwarieme, T. A., Esewe, R. E., & Emina, A. (2024).* Educational intervention effect on nurses' knowledge of Glasgow Coma Scale for neurological patient assessment in tertiary hospitals in Edo State, Nigeria. *Evidence-Based Nursing Research*, *6*(3), 20-31. https://doi.org/10.47104/ebnrojs3.v6i3.339

1. Introduction

Consciousness is an individual's ability to respond to stimuli and be aware of the environment in which one is, while unconsciousness is a state in which a person cannot be aroused even with painful stimuli *(Wong & Hockenberry, 2011)*. Coma is a total loss of consciousness that represents the final pathway of pathophysiological processes in disease states (trauma, epilepsy, neoplasm, seizures). It ultimately leads to derangement in cerebral function manifested as decreased arousal and awareness *(Huff et al., 2012).*

According to *the World Health Organization (WHO) (2013*), traumatic brain injury (TBI), which is the most common cause of unconsciousness, will surpass many diseases as the primary cause of mortality and dysfunction by the end of 2030. Given the estimation that 10 million people will be affected annually by the TBI, the burden of death and infirmity this condition places on society raises a serious medical and public health concern. The effect of TBI is evident globally and is especially prominent in low and middle-income countries like Nigeria, which faces a greater level of susceptibility to TBI and has inadequately prepared health systems to address the related negative results *(WHO, 2013).* Thus, neurological conditions that can lead to loss of consciousness affect everybody and are the result of impairment to the brain, spinal cord, and nerves from disease or trauma.

The level of consciousness (LOC) is the sensitive and reliable indicator of the patient's neurological functioning. The change in responsiveness helps to find out if there is any impairment in the nervous system that can happen even without observable damage to the patient. Therefore, the level

[1]*Correspondence author: Timothy Aghogho Ehwarieme*

of consciousness/coma should be frequently measured. This measure requires a scoring tool that can show a visual trend of assessments and establishes a yardstick from which nurses and other healthcare professionals can perform, compare, and repeat assessments of a patient's level of consciousness and thus adjust treatment accordingly *(Vink et al., 2018).*

Over the years, specialists have designed several tools to address this need, of which the Glasgow Coma Scale (GCS) remains the benchmark for over 40 years *(Teasdale et al., 2014).* GCS is the cornerstone of the neurological assessment of patients used by both nursing and medical staff that measures the degree of consciousness under three distinct categories of neurological functioning, and each category has a further subdivision and a score *(Geraghty, 2005).* It gives a reliable, objective way of recording the conscious state of a person, for initial as well as subsequent assessment. Assessing the level of consciousness is part of health professionals' primary functions, especially for those working in critical care units, emergency services (ES), and intensive care units (ICU) *(Santos et al., 2016).* According to *Vink et al. (2018),* a study involving nurses in eleven different countries showed an assessment of consciousness as part of the daily routine for the majority (95%) of bedside nurses, with an estimated median frequency of six times per shift and that majority use a standardized instrument GCS.

Given its importance in the neurological evaluation of patients and its meticulous and standardized application, using GCS requires good knowledge and skills. Therefore, evaluating health professionals' knowledge of this scale is fundamental to guarantee uniformity, reliability, and accuracy in applying GCS. However, many studies have reported that nurses lack knowledge of the GCS *(Kaur et al., 2016; Ehwarieme & Anarado, 2016; Mohammed et al., 2013; Kaur et al., 2016; Kimboka, 2017).*

These findings and those of other researchers indicate that nurses lack knowledge of GCS and cannot translate the knowledge into actual practice. Nurses do a great job caring for patients with neurological conditions from admission to discharge. These activities include assessing the level of consciousness using the GCS, monitoring vital signs and increased intracranial pressure (ICP), assessing motor functions, and providing other nursing care. Each care activity demands specialized knowledge to be carried out effectively *(Kumar, 2015).* However, evidence from empirical studies suggests that nurses encounter problems when completing some aspects of the GCS with the potential for performing an incorrect assessment due to inadequate knowledge *(Waterhouse, 2008).*

Previous studies have highlighted crucial issues in neurological patient care regarding inadequate knowledge and use of the Glasgow Coma Scale (GCS) among nurses. This finding aligns with studies by *Batool et al. (2013), Hien and Chae (2011) in Vietnam, Ehwarieme, and Anarado (2016), and Ehwarieme et al. (2021),* suggesting a global trend of nurses needing improvement in GCS knowledge application.

2. Significance of the study

Nigeria is experiencing increasing cases of head injury and other neurological conditions that lead to unconsciousness *(Emejulu et al., 2009; Emejulu et al., 2010; Adogu et al., 2015; Jasper et al., 2014; Oyedele et al., 2015);* and especially in Edo state *(Udoh & Adeyemo, 2013; Dongo et al., 2013)* which require the use of GCS in monitoring patients. In the clinical setting, the need for educational intervention in the neurological assessment of patients using the GCS has been identified in Edo state, Nigeria *(Ehwarieme et al., 2021),* and the lack of unsuccessful studies of educational interventions for nurses in the clinical area is indicative of the need for further studies. Also, as the trends in nursing care are changing with scientific and technological growth, nurses must acquaint themselves with them *(Ann-Charlotte, 2015).* Therefore, this study assessed the effect of an educational intervention on nurses' knowledge of GCS in the neurological assessment of patients in selected tertiary hospitals in Edo State, Nigeria.

This study has convincingly demonstrated the effectiveness of a developed educational intervention package in improving nurses' knowledge of the GCS. The self-instructional format of this package offers an appealing approach to promoting self-directed learning among nurses. This package can empower nurses to confidently assess patients using the GCS, interpret scores accurately, and apply their knowledge in clinical practice.

3. Aim of the study

This study aimed to assess the effect of an educational intervention on nurses' knowledge of GCS in the neurological assessment of patients in selected tertiary hospitals in Edo State, Nigeria.

4. Subjects & Methods

4.1. Research Design

The researchers adopted a 2x3 non-equivalent control group, pre-test-post-test quasi-experimental research design. *Polit and Beck (2014)* described this design as involving two groups of participants from whom outcome data are collected before and after implementing an intervention. This design is suitable when a researcher wants to determine the impact or effect of policy changes, educational interventions, or large-scale health interventions on a large target population *(Derue et al., 2012).*

4.2. Study setting

The study was conducted in Edo State, Nigeria. Two tertiary federal hospitals in the state, which served as training institutions for health professionals, including nurses and referral centers, were purposefully selected for this study and assigned as the intervention (A) and control (B) groups, with an anticipated high volume of neurological patient population.

4.3. Subjects

A proposed total population study of all nurses (101) working in neurological wards of the two selected tertiary hospitals. The intervention group had 50 participants, and the control group had 51 participants. A simple random sampling technique using balloting was used to assign the hospitals into intervention and control groups. A purposive sampling technique was used to select the participants for the study in both groups. Therefore, any of the one hundred and

one (101) nurses who met the inclusion criteria were enlisted for the study.

Inclusion criteria

- All nurses who work and manage unconscious patients in the selected wards/units of the two selected hospitals.
- Must have worked for at least six months in the selected wards/units and were not on leave of any type and were on duty or physically available to participate in the study.
- Gave their informed consent to participate in the study.

4.4. Tools of data collection

4.4.1. Structured-Self-Administered Questionnaire

The researcher developed a structured-self-administered questionnaire with three sections. Section one contained the socio-demographic data of the respondents. Section two contained 15 MCQs relating to basic knowledge of the Glasgow coma scale as applicable in neurological assessment.

Each item has a multiple-choice response format to choose the correct response. Each correct response scores 1 point, grading at three levels. A score of 1-5 correct responses denotes poor knowledge, 6-10 correct responses denotes average knowledge and 11-15 correct responses denotes good knowledge.

Section three contained questions related to knowledge of skills in eliciting and rating behaviors, interpretation of the Glasgow coma score, and its clinical implications. It has 22-item questions where each item has different options to choose from the most correct response.

Each correct response received a score of 1 and was graded on four levels. A score of 1-5 correct responses were regarded as poor, 6-10 correct responses as fair, 11-15 as good, and 17-22 as very good. Generally, the total knowledge of GCS has the following classification: Poor (1-9), fair (10-19), good (20-28), and very good (29-37).

4.5. Procedures

Five experts did face and content validity of the instruments: Two consultant neurologists, two experienced nurse clinicians working in the neuro ward and accident and emergency, and one academician, a professor of neuroanatomy/toxicology. The reliability of the instruments was ascertained by pilot testing the questionnaire among ten staff nurses (representing 10% of the total population of the study) working in a similar ward in another tertiary hospital in another state. Data obtained were subjected to a split-half reliability test. The internal consistency result for each component showed section two: basic knowledge (0.832), section three: knowledge relating to skill (0.801).

Ethical Consideration: The researchers obtained ethical clearance with protocol numbers ISTH/HREC/20202002/059 and ADM/E22/AVOL.VII/148271 from both hospitals. The researchers maintained confidentiality of information and obtained informed consent from participants, who were free to withdraw from the study at any time.

The development of an educational intervention package (EIP) on the use of GCS in the neurological assessment of patients was based on the result of the learning needs assessment conducted using a mixed-method research design. In addition to a review of literature, consultation with experts in the field of neurology, including experienced nurses in the field of neurological nursing, previous research conducted by the researchers, and personal experiences of the researchers during clinical teaching in the ward with student nurses were also of great help in developing the EIP. There were four steps involved in the development of the EIP.

- Conducted a needs assessment among nurses on the neurological assessment of patients using a mixed-method research design.
- Review of literature on neurological assessment consults experts in neurology.
- Preparation of the first draft of the EIP.
- Validation of the draft by the same experts mentioned earlier.
- Preparation of the final draft incorporating input from experts.
- Editing of the modules EIP.

The researcher recruited four registered nurses as research assistants and trained them to administer the questionnaire.

Pre-intervention data collection visit involved a feasibility study of the setting and other logistics. In this phase, the researcher enlisted the nurses in the neuro ward of the selected hospitals who were interested and consented to participate in the study.

Time One Data Collection Sessions: The researchers administered a pre-test to the participants using the questionnaire, which was collected immediately after they filled it out. They did this stage in two sessions on the same day: a morning session (11 am—12 noon) for those on afternoon duty and an afternoon session (3 - 4 pm) for those on morning duty.

Delivery of Intervention Package (EIP): It involved delivering the educational intervention package by the researchers to the participants/respondents in the intervention group, which lasted for six (6) days. The educational package was delivered in two sessions: morning session (11 am - 12 noon) for those on afternoon duty and afternoon session (3 - 4 pm) for those on morning duty each day. During this period, a placebo in the form of a seminar on the "treatment of pressure ulcers" was held with the control group.

Time 2 Data Collection (Post-test 1): Two (2) weeks after the intervention, the knowledge of post-test one was assessed.

Time 3 Data Collection (Post-test 2): Eight (8) weeks after the first post-test, participants were reassessed for knowledge retention.

4.6. Strength of the study

The study tackles a relevant issue: The lack of GCS knowledge among nurses caring for neurological patients. This knowledge gap can negatively impact patient care. The non-equivalent control group design helps establish a cause-and-effect relationship between the intervention and the observed improvement in knowledge. Using a researcher-developed questionnaire with good internal consistency

(Cronbach's alpha of 0.832) strengthens the study's credibility. Including a post-test two (eight weeks after the intervention) helps assess knowledge retention, a crucial aspect of skill development.

4.7. Limitations of the study

While the study offers valuable insights, some limitations need to be considered: The sample size of 98 nurses is relatively small. A larger sample could enhance the generalizability of the findings to a wider population of nurses. There might need to be more than the eight-week follow-up period to assess long-term knowledge retention and practical skill application in the clinical setting. The study relies on self-reported knowledge through questionnaires, which might not fully capture nurses' skills or ability to apply knowledge in clinical situations.

4.8. Data analysis

Descriptive statistics: Continuous data that followed normal distribution were analyzed and presented using mean, while those not normally distributed were described using the median and interquartile range. Categorical variables were described using frequency, proportions, and percentages. Inferential statistics were done with nonparametric tests at a 5% significance level. The chi-square test for bivariate analysis, Mann Whitney U test was used to compare the median between groups. Friedman's test was used to compare within groups (pre-, post-1, and post-2). All analyses used IBM Statistical Package for Social Sciences (SPSS version 26.0) for Windows.

5. Results

Intervention group (A): Number of recruited staff =50, number of those who participated in the pre-test =50. No. of those who completed the EIP module =48 or those who participated in post-tests 1 and 2 =48. Number of dropouts 2(4%). Control group (B): Number of recruited staff =51, number of those who participated in the pre-test =51. None of those who participated in post-tests 1 and 2 =50. Number of dropouts 1(2%). Total number of dropouts from the study 3(3%). The actual number that participated in both intervention and control was 98.

Table 1 shows the socio-demographic characteristics of nurses in the control and intervention groups. The modal age group was between 21 and 30, with a mean age of 35.23±9.56 and 30.22±6.12 for both intervention and control groups, respectively. The participants were mostly females, with 36(75.0%) in the intervention group and 35(70.0%) among the controls. Non-statistically significant differences between the two groups were revealed regarding gender, highest qualifications, professional certificates, receiving previous training on GCS at p>0.05.

Table 2 shows that the level of basic knowledge of GCS among the participants in the intervention group increased from good knowledge 1(2.1%) pre-test to 25(52.1%) post-test one and reduced to 17(35.4%) post-test two. In comparison, the level of good knowledge was on the decline (pre-test 3(6.0%), post-test one 2(4.0%), and post-test two 1(2.0%) for the control group.

Table 3 shows the level of knowledge regarding GCS skills among the participants in the intervention group. The knowledge increased from 0 (0.0%) in pre-test to very good knowledge, 27 (56.3%) in post-test one, and 21 (43.8%) in post-test two. At the same time, the level of good knowledge was on the decline (pre-test 3(6.0%), post-test one 0(0%), and post-test two 2(4.0%) for the control group.

Table 4 shows that the overall level of knowledge on GCS among the intervention group participants increases from very good knowledge pre-test 0(0%) to post-test one 29(60.4%) and post-test two 15(31.3%). None was reported in the control group throughout the periods.

Table 5 shows that in the control group, there was no significant difference over the assessment times in knowledge relating to GCS skills (p=0.306); for participants in the intervention group, there were significant differences over the assessment times in knowledge relating to GCS skills (p=0.000). Post hoc (Bonferroni) revealed significant differences between the pre-test compared to post-test one and post-test two (p=0.000).

It also shows the intervention's effect on the overall knowledge of GCS. There was no significant difference (p=0.261) over the assessment times in the control group, while a significant difference (p=0.000) over the assessment times was found in the intervention group. Post hoc (Bonferroni) revealed that significant differences found in the intervention group were between pre versus post-one and posted two.

Table 6 shows the comparison of different domains of the GCS scale. There were no significant differences (p>0.05) between intervention and control during pre-intervention. In post-one, the intervention group reported significantly higher (p<0.05) scores than the control group. In post-two, the intervention group reported significantly higher (p<0.05) scores than the control group. This finding implies that the intervention has led to a gain in knowledge among the participants in the intervention group.

Further testing the effectiveness of the intervention package, a chi-square analysis was done, as shown in bivariate table 7. This analysis revealed that there was no association between socio-demographic characteristics and level of knowledge on GCS among participants pre-intervention in the intervention group (p>0.05).

Table 8 reveals the association between socio-demographic characteristics and the level of knowledge of GCS among participants in the control groups after intervention. It shows that none of the socio-demographic characteristics are significantly associated (p>0.05) with the level of knowledge of GCS pre-intervention for control groups.

Table 9 reveals the association between socio-demographic characteristics and the level of knowledge on GCS among participants post-intervention for the intervention group. The finding showed a non-statistically significant association between socio-demographic characteristics and level of knowledge on GCS among participants post-intervention for the intervention group (p>0.05). Implying that any observed change in scores were from the intervention.

Table (1): Nurses' Demographic characteristics in intervention and control groups.

	Intervention		Control		χ^2	p
	n=48	%	n=50	%		
Gender						
Male	12	25.0	15	30.0	0.307	0.580
Female	36	75.0	35	70.0		
Age group						
21-30	20	41.7	32	64.0		
31–40	14	29.2	16	32.0	12.200	0.000
41–50	10	20.8	2	4.0		
51–60	4	8.3	0	0.0		
Mean age±SD	35.23±9.56		30.22±6.12		3.103‡	0.003
Highest Academic Qualification						
Diploma	19	39.6	29	58.0		
First Degree	24	50.0	18	36.0	3.401	0.183
Higher Degree	5	10.4	3	6.0		
Professional Certification†						
RN only	40	95.2	45	93.8		
RN/RM	29	69.0	35	72.9	7.745	0.101
RN/Accident and emergency nurse	2	4.8	11	22.9		
RN/Registered Intensive Care nurse	1	2.4	4	8.3		
Job Status						
NO II	13	27.1	13	26.0		
NO I	15	31.3	11	22.0		
SNO	9	18.8	10	20.0	18.908	0.002
PNO	8	16.7	0	0.0		
ACNO	0	0.0	8	16.0		
CNO	3	6.3	8	16.0		
Years of Experience						
1-2	12	25.5	0	0.0		
3-5	8	17.0	20	42.6	19.036	0.000
6-10	13	27.7	18	38.3		
Greater than 10	14	29.8	9	19.1		
Have you received Training on GCS before						
Yes	32	66.7	28	56.0	1.174	0.279
No	16	33.3	22	44.0		
If yes, how long did it last?						
1week	16	50.0	6	23.1		
>1weeks -<1month	11	34.4	5	19.2		
>1month-<3months	3	9.4	5	19.2	12.177	0.016
>3month-<6months	1	3.1	6	23.1		
>6months and above	1	3.1	4	15.4		

Table (2): Participants' level of knowledge on basic questions related to GCS in both intervention and control.

Levels of Knowledge,	Range of correct scores	Intervention		Control	
		n=48	%	n=50	%
Pre-test					
Poor	1-5	34	70.8	34	68.0
Fair	6-10	13	27.1	13	26.0
Good	11-15	1	2.1	3	6.0
Post-test one					
Poor	1-5	0	0.0	37	74.0
Fair	6-10	23	47.9	11	22.0
Good	11-15	25	52.1	2	4.0
Post-test two					
Poor	1-5	0	0.0	37	74.0
Fair	6-10	31	64.6	12	24.0
Good	11-15	17	35.4	1	2.0

Table (3): Participant's level of knowledge regarding GCS Skills.

Levels of Knowledge,	Range of correct scores	Intervention		Control	
		n=48	n=48	n=50	n=50
Pre-test					
Poor	1-5	9	18.8	1	2.0
Fair	6-10	37	77.1	46	92.0
Good	11-15	2	4.2	3	6.0
Very good	16-22	0	0.0	0	0.0
Post-test one					
Poor	1-5	0	0.0	1	2.0
Fair	6-10	0	0.0	49	98.0
Good	11-15	21	43.8	0	0.0
Very good	16-22	27	56.3	0	0.0
Post-test two					
Poor	1-5	0	0.0	5	10.0
Fair	6-10	1	2.1	43	86.0
Good	11-15	26	54.2	2	4.0
Very good	16-22	21	43.8	0	0.0

Table (4): Participant's overall knowledge (basic and skill knowledge) of GCS

	Score range	Intervention		Control	
		n=48	%	n=50	%
Pre-test					
Poor	1-9	9	18.8	3	6.0
Fair	10-19	37	77.1	41	82.0
Good	20-28	2	4.2	6	12.0
Very Good	29-37	0	0.0	0	0.0
Post-test one					
Poor	1-9	0	0.0	0	0.0
Fair	10-19	0	0.0	47	94.0
Good	20-28	19	39.6	3	6.0
Very Good	29-37	29	60.4	0	0.0
Post-test two					
Poor	1-9	0	0.0	4	8.0
Fair	10-19	0	0.0	43	86.0
Good	20-28	33	68.8	3	6.0
Very Good	29-37	15	31.3	0	0.0

Table (5): Difference in the participants' pre-test and post-test knowledge of GCS between the intervention and control groups

Groups	Pre	Post 1	Post 2	Friedmann	p
Intervention group	**n=50**	**n=48**	**n=48**		
Summary Knowledge relating to GCS skills	7.00(6.00-9.00)[a]	18.00(16.25-19.00)[b]	17.00(16.00-19.00)[b]	77.200	0.000
Knowledge relating to skills in each component					
Eye-opening component	2.00(2.00-3.00)[a]	4.00(4.00-5.00)[b]	4.50(3.00-5.00)[b]	47.288	0.000
The best verbal response	2.00(2.00-3.75)[a]	6.00(5.00-6.00)[b]	5.00(4.00-5.75)[c]	90.074	0.000
The best motor response	3.00(2.00-3.00)[a]	8.00(7.00-9.00)[b]	8.00(7.00-9.00)[b]	78.259	0.000
Overall GCS knowledge(basic knowledge of GCS and knowledge regarding skills)	13.00(11.0015.00[a]	30.00(28.00-31.00)[b]	28.00(27.00-30.00)[b]	75.064	0.000
Control group	**n=51**	**n=50**	**n=50**		
Summary Knowledge relating to GCS skills	7.00(7.00-9.00)[a]	7.00(7.00-8.00)[a]	7.00(6.00-9.00)[a]	2.369	0.306
Knowledge relating to skills in each component					
Eye-opening component	2.00(2.00-4.00)[a]	2.00(2.00-2.00)[a]	2.00(2.00-2.25)[a]	0.661	0.719
The best verbal response	2.00(2.00-2.00)[a]	2.00(2.00-2.00)[a]	2.00(1.00-3.00)[b]	28.738	0.000
The best motor response	3.00(3.00-3.00)[a]	3.00(2.00-3.00)[a]	3.00(3.00-3.00)[a]	3.059	0.217
Overall GCS knowledge (basic GCS knowledge and knowledge regarding skills)	12.00(11.0017.00[a]	12.00(11.00-15.25)[a]	12.00(10.00-14.00)[a]	2.685	0.261

Key "a" (means no significant difference exists), "b" (means significant difference exists).

Table (6): Comparison of the different domains of knowledge of GCS among the study and control groups pre-, post-one, and post-two assessment.

	Intervention n=48	Control n =50	Mann Whitney	p
Comparison of different domains (Pre-test)				
Basic Knowledge Score of GCS	5.00(4.00-7.00)	5.00(4.00-8.25)	-0.479	0.632
Knowledge relating to GCS skills in each component				
Eye-opening component	2.00(2.00-3.00)	2.00(2.00-4.00)	-0.251	0.802
The best verbal response	2.00(2.00-3.75)	2.00(2.00-2.00)	-0.624	0.532
The best motor response	3.00(2.00-3.00)	3.00(3.00-3.00	-2.187	0.029
Comparison of different domains (Post-test one)				
Basic Knowledge score	12.00(11.0013.00)	5.00(5.00-7.25)	-7.884	0.000
Knowledge relating to GCS skills in each component				
Eye-opening	4.00(4.00-5.00)	2.00(2.00-2.00)	-8.208	0.000
The best verbal response	6.00(5.00-6.00))	2.00(2.00-2.00)	-8.554	0.000
Best motor response	8.00(7.00-9.00)	3.00(2.00-3.00)	-8.363	0.000
Comparison of different domains (Post-test two)				
Basic Knowledge score	11.00(11.00-12.00)	4.00(4.006.00)	-8.026	0.000
Knowledge relating to GCS skills in each component				
Eye-opening	4.50(3.00-5.00)	2.00(2.002.25)	-7.062	0.000
The best verbal response	5.00(4.00-5.75)	2.00(1.003.00)	-8.056	0.000
Best motor response	8.00(7.00-9.00)	3.00(3.003.00)	-8.536	0.000

Values are expressed as median (Interquartile range)

Table (7): Association of the pre-test knowledge of GCS among the participants and their social demographic characteristics in the intervention group.

Variables	Poor		Fair		Good		Very good		χ^2	p
	No.	%	No.	%	No.	%	No.	%		
Gender										
Male	3	25.0	8	66.7	1	8.3	0	0.0	1.22	0.54
Female	6	16.7	29	80.6	1	2.8	0	0.0		
Highest academic qualification										
Diploma (RN)	4	21.1	15	78.9	0	0.0	0	0.0		
First Degree	4	16.7	18	75.0	2	8.3	0	0.0	2.14	0.71
Higher Degree	1	20.0	4	80.0	0	0.0	0	0.0		
Age group										
21-30	3	15.0	16	80.0	1	5.0	0	0.0		
31-40	4	28.6	10	71.4	0	0.0	0	0.0	7.23	0.29
41-50	1	10.0	9	90.0	0	0.0	0	0.0		
51-60	1	25.0	2	50.0	1	25.0	0	0.0		
Job Status										
NO II	2	15.4	11	84.6	0	0.0	0	0.0		
NO I	3	20.0	12	80.0	0	0.0	0	0.0		
SNO	2	22.2	6	66.7	1	11.1	0	0.0	10.41	0.23
PNO	1	12.5	7	87.5	0	0.0	0	0.0		
ACNO	0	0.0	0	0.0	0	0.0	0	0.0		
CNO	1	33.3	1	33.3	1	33.3	0	0.0		
Years of Experience										
1-2	3	25.0	9	75.0	0	0.0	0	0.0		
3-5	1	12.5	7	87.5	0	0.0	0	0.0	2.19	0.90
6-10	2	15.4	10	76.9	1	7.7	0	0.0		
Greater than 10	3	21.4	10	71.4	1	7.1	0	0.0		
Have you received training on GCS before										
Yes	5	15.6	25	78.1	2	6.3	0	0.0	1.51	0.46
No	4	25.0	12	75.0	0	0.0	0	0.0		
If yes, which of the following duration days										
1week	4	25.0	10	62.5	2	12.5	0	0.0		
>weeks -<months	1	9.1	10	90.9	0	0.0	0	0.0		
>month-<3months	1	33.3	2	66.7	0	0.0	0	0.0	4.49	0.8
>3month-<6months	0	0.0	1	100.0	0	0.0	0	0.0		
>6months and above	0	0.0	1	100.0	0	0.0	0	0.0		

Table (8): Association of the pre-test knowledge of GCS among the participants and their social demographic characteristics in the control group.

Variables	Poor		Fair		Good		Very good		χ^2	p
	No.	%	No.	%	No.	%	No.	%		
Gender										
Male	0	0.0	14	93.3	1	6.7	0	0.0	2.12	0.34
Female	3	8.6	27	77.1	5	14.3	0	0.0		
Highest academic qualification										
Diploma (RN)	3	10.3	22	75.9	4	13.8	0	0.0		
First Degree	0	0.0	17	94.4	1	5.6	0	0.0	4.57	0.33
Higher Degree	0	0.0	2	66.7	1	33.3	0	0.0		
Age group										
21-30	3	9.4	27	84.4	2	6.3	0	0.0		
31-40	0	0.0	12	75.0	4	25.0	0	0.0	5.25	0.26
41-50	0	0.0	2	100.0	0	0.0	0	0.0		
51-60	0	0.0	0	0(0.0)	0	0.0	0	0.0		
Job Status										
NO II	2	15.4	9	69.2	2	15.4	0	0.0		
NO I	0	0.0	10	90.9	1	9.1	0	0.0		
SNO	1	10.0	8	80.0	1	10.0	0	0.0	6.85	0.55
PNO	0	0.0	0	0.0	0	0.0	0	0.0		
ACNO	0	0.0	8	100.0	0	0.0	0	0.0		
CNO	0	0.0	6	75.0	2	25.0	0	0.0		
Years of Experience										
1-2	0	0.0	0	0.0	0	0.0	0	0.0		
3-5	2	10.0	15	75.0	3	15.0	0	0.0	2.68	0.61
6-10	1	5.6	16	88.9	1	5.6	0	0.0		
Greater than 10	0	0.0	7	77.8	2	22.2	0	0.0		
Have you received training on GCS before										
Yes	1	3.6	24	85.7	3	10.7	0	0.0	0.82	0.66
No	2	9.1	17	77.3	3	13.6	0	0.0		
If yes, which of the following duration days										
1week	2	0.0	6	100.0	0	0.0	0	0.0		
>weeks -<months	2	0.0	5	100.0	0	0.0	0	0.0		
>month-<3months	2	0.0	4	80.0	1	20.0	0	0.0	6.27	0.61
>3month-<6months	1	16.7	4	66.7	1	16.7	0	0.0		
>6months and above	0	0.0	3	75.0	1	25.0	0	0.0		

6. Discussion

The present study is a follow-up to a study on clinical nurses' knowledge and skills. Learning needs about the Glasgow Coma Scale for neurological patients' assessment in tertiary hospitals in Edo state, Nigeria, conducted by *Ehwarieme et al. (2021)*. The study by *Ehwarieme et al. (2021)* highlights a crucial issue in neurological patient care concerning inadequate knowledge and use of the Glasgow Coma Scale (GCS) among nurses. This finding aligns with findings from other studies; for example, a study by *Mohammed et al. (2013)* found that nurses' GCS knowledge often does not translate well into clinical practice. Similar results were reported by *Hien and Chae (2011)* in Vietnam.

These findings, alongside *Ehwarieme et al. (2021)*, suggest a global trend of nurses needing improvement in GCS knowledge and application. The reasons identified by *Ehwarieme et al. (2021)* for this knowledge gap also concern the lack of continuous GCS use in practice, which suggests a potential disconnect between theoretical education and real-world application and limited continuing education and professional development. Corroborating the need for intervention, *Ehwarieme et al. (2021)* propose educational intervention packages as a solution. This finding aligns with the current recommendations of *Mohammed et al. (2013)*, which emphasize the importance of ongoing GCS training programs for nurses. Therefore, developing and testing educational interventions for nurses on GCS use was a critical step toward improving patient care, leading to the present study, which is to assess the effect of an educational intervention on nurses' knowledge of GCS in the neurological assessment of patients in selected tertiary hospitals in Edo State, Nigeria.

The present study's findings offer valuable insights into the demographic characteristics of the respondents. It shows that they are predominantly female, which aligns with the nursing profession's demographics worldwide. However, it is important to acknowledge that this gender dominance might not be generalizable to all regions or healthcare settings. The statistically similar socio-demographic characteristics (except for age, job status, experience, and GCS training duration) between the intervention and control groups strengthen the study's design. This similarity helps ensure that any observed differences in GCS knowledge after the intervention are likely due to the intervention itself, not pre-existing group differences.

Most participants reported receiving GCS training, yet their pre-test scores indicated a knowledge gap. This finding highlights a potential disconnect between the content or effectiveness of the reported training and nurses' actual GCS knowledge. Studies like Mohammed et al. (2013) suggest the importance of ongoing, well-designed GCS training programs for nurses. The current study's findings imply that simply receiving GCS training might not be sufficient, and the content and delivery methods need further exploration.

Table (9): Association of the post-test knowledge on GCS among the participants and their social demographic characteristics in the intervention group.

Variables	Poor		Fair		Good		Very good		χ^2	p
	No.	%	No.	%	No.	%	No.	%		
Gender										
Male	0	0.0	0	0.0	5	41.7	7	58.3	0.029	0.865
Female	0	0.0	0	0.0	14	38.9	22	61.1		
Highest academic qualification										
Diploma (RN)	0	0.0	0	0.0	7	36.8	12	63.2		
First Degree	0	0.0	0	0.0	11	45.8	13	54.2	1.254	0.534
Higher Degree	0	0.0	0	0.0	1	20.0	4	80.0		
Age group										
21-30	0	0.0	0	0.0	7	35.0	13	65.0		
31-40	0	0.0	0	0.0	5	35.7	9	64.3	0.899	0.826
41-50	0	0.0	0	0.0	5	50.0	5	50.0		
51-60	0	0.0	0	0.0	2	50.0	2	50.0		
Job Status										
NO II	0	0.0	0	0.0	5	38.5	8	61.5		
NO I	0	0.0	0	0.0	4	26.7	11	73.3		
SNO	0	0.0	0	0.0	5	55.6	4	44.4	2.948	0.567
PNO	0	0.0	0	0.0	3	37.5	5	62.5		
ACNO	0	0.0	0	0.0	0	0.0	0	0.0		
CNO	0	0.0	0	0.0	2	66.7	1	33.3		
Years of Experience										
1-2	0	0.0	0	0.0	5	41.7	7	58.3		
3-5	0	0.0	0	0.0	3	37.5	5	62.5		
6-10	0	0.0	0	0.0	4	30.8	9	69.2	1.072	0.784
Greater than 10	0	0.0	0	0.0	7	50.0	7	50.0		
Have you received Training on GCS before										
Yes	0	0.0	0	0.0	12	37.5	20	62.5	0.174	0.676
No	0	0.0	0	0.0	7	43.8	9	56.3		
If yes, which of the following duration days										
1week	0	0.0	0	0.0	5	31.3	11	68.8		
>weeks -<months	0	0.0	0	0.0	5	45.5	6	54.5		
>month-<3months	0	0.0	0	0.0	1	33.3	2	66.7	2.853	0.583
>3month-<6months	0	0.0	0	0.0	0	0.0	1	100.0		
>6months and above	0	0.0	0	0.0	1	100.0	0	0.0		

The study's findings on nurses' pre-test scores align with a concerning trend observed in multiple global studies. The study identified a poor overall level of GCS knowledge among nurses in both the intervention and control groups. This finding aligns with previous research from *Ogunfowokan et al. (2010)* in Nigeria deficits in motor response assessment, *Hien and Chae (2011)* in Vietnam reported low scores across all GCS components, *Batool et al. (2013)* in Iraq reported inadequate knowledge on all GCS items, and *Ehwarieme and Anarado (2016)* in Nigeria who reported poor knowledge on clinical application and special situations. These studies and the current one paint a concerning picture of a global knowledge gap in GCS assessment among nurses. This gap could hinder the quality of care provided to neurological patients. The current study does not detail the reported prior GCS training participants received. However, the knowledge gap suggests that the content or delivery of this training might be inadequate. Studies like *Batool et al. (2013)* emphasize the need for well-designed, ongoing GCS training programs. The findings highlight the need for improved GCS training programs for nurses. These programs should prioritize comprehensive content covering all GCS components and their clinical application, interactive formats that encourage active learning and skill development, and regular refreshers to address knowledge decay.

Corroborating further the current study's findings and the cited research reveals a concerning global trend. Nurses across various countries demonstrate poor to moderate knowledge of the Glasgow Coma Scale (GCS). This finding is evident in the studies by *Kaur et al. (2016)* in Malaysia (only 2.96% scored well), *Kimboka (2017)* in Tanzania (over half did not know the lowest score), *Alhassan et al. (2019)* in Ghana, *Ayoub et al. (2018)* in the United Arab Emirates, and *Kaur et al. (2016)* in Malaysia. This widespread knowledge gap is worrisome because the GCS is a crucial tool for assessing unconscious patients and monitoring neurological status. Compared to *Ehwarieme and Anarado (2016)* conducted in the same hospital four years prior, the current study suggests a concerning trend. Nurses' GCS knowledge and application skills seem to deteriorate over time. This finding highlights the need for ongoing training and reinforcement strategies. The studies collectively emphasize the need for a multi-prolonged approach, such as developing effective training programs, regular refreshers, and promoting practical use.

The current study's findings offer encouraging evidence regarding the effectiveness of educational interventions in improving nurses' knowledge of the Glasgow Coma Scale (GCS). The intervention group demonstrated a significant increase in GCS knowledge compared to the control group. This finding aligns with studies by *Mohammed et al. (2013)*, who emphasize the importance of ongoing GCS training programs. These findings suggest that well-designed educational interventions can effectively bridge the GCS knowledge gap identified in previous research cited above. The study's finding of high knowledge retention eight weeks after the intervention is particularly valuable. This finding indicates that the intervention's design likely fostered long-term knowledge retention, which is crucial for effective clinical practice.

Furthermore, the current study provides strong evidence for the effectiveness of an educational intervention package in improving nurses' knowledge of the Glasgow Coma Scale (GCS). The statistically non-significant difference in GCS knowledge between the intervention and control groups establishes a baseline equivalence before the intervention. This finding strengthens the study's design, suggesting that any observed improvements in the intervention group can be confidently attributed to the intervention. The sharp increase in knowledge scores after the intervention in the group receiving the educational package aligns with similar findings in other studies by *Mohammed et al. (2013)*, who highlight the importance of ongoing GCS training. Importantly, while the knowledge score dropped slightly in the second post-test for the intervention group, the difference was statistically insignificant. This finding suggests relatively good knowledge retention eight weeks after the intervention, similar to the previous studies' findings *(Mohammed et al., 2013).* The control group's scores remained relatively unchanged throughout the study, further supporting the conclusion that the improvement in the intervention group stemmed from the educational package.

Moreover, the finding that socio-demographic characteristics were not associated with knowledge gain strengthens the argument that the intervention caused the improvement. This finding suggests that the program was effective for nurses regardless of age, experience, or other background factors. However, the slight decline over time suggests that reinforcement strategies might be beneficial to ensure long-term knowledge retention and application. This finding could involve refresher training sessions, online modules or skills practice opportunities, and integration of GCS assessment into clinical practice routines.

The current study's findings regarding the educational intervention and nurses' GCS knowledge align with the results of *O'Farrell and Zou (2008)* in Canada and *Teles et al. (2013)*, who reported that their pre-test results showed a majority of nurses with average or poor GCS knowledge. After an educational intervention (Self Instructional Module), knowledge scores improved significantly, also, *Hussein (2015)* in Egypt echoes the same pattern. Nurses' initial knowledge about coma and GCS was poor, but it improved markedly after receiving instructional guidelines. Other studies include who reported similar patterns were *Kumar (2015), Ann-Charlotte (2015), Ahamed and Dutta (2016), Elhagga and Eldesouky (2016), and Kamothi (2016)* further strengthened the evidence base. These studies, conducted in various locations globally, consistently demonstrate the positive impact of educational interventions on nurses' knowledge in different healthcare areas. This collective evidence highlights the crucial role of educational interventions in addressing knowledge gaps and improving nurses' competence. This finding, in turn, contributes to enhanced patient care, improved confidence, and standardized practice.

Notably, the current study suggests a higher effectiveness of the educational intervention than previous research on GCS training for nurses. This finding may be due to the intervention design, structure, delivery mode, or environmental conditions of the venue used in delivering the intervention package. These factors can significantly impact learning effectiveness. Secondly, the study focused on nurses in an adult neurological ward. Compared to settings like pediatric units or emergency departments, nurses in adult neurological wards likely encounter patients requiring GCS assessment more frequently. This exposure increased the practical application and could enhance knowledge retention after the intervention.

7. Conclusion

This study has convincingly demonstrated the effectiveness of the developed educational intervention package in improving nurses' knowledge of the GCS. The self-instructional format offers an appealing approach to promoting self-directed learning among nurses. This approach can empower nurses to confidently assess patients using the GCS, interpret scores accurately, and apply their knowledge in clinical practice. Furthermore, these findings encourage healthcare institutions in Nigeria and globally to implement similar programs to bridge the GCS knowledge gap among nurses caring for neurological patients, enhance nurses' confidence in applying GCS for accurate patient assessment, and ultimately improve patient care by ensuring accurate neurological assessments and timely interventions.

8. Recommendations

- Integrate GCS training into the nursing curriculum at educational institutions.
- Provide opportunities for nurses to practice GCS assessments on mannequins or simulated scenarios.
- Encourage regular use of GCS by incorporating it into standard patient assessment protocols.
- Hospitals in Edo State, and potentially across Nigeria, should consider implementing this educational program for nurses, particularly those working in neurological wards.
- The study suggests that the program's self-instructional format was well-received. Consider developing similar self-learning modules for nurses on other essential neurological assessment tools. These modules empower nurses to continue learning independently and stay updated.

- Future studies should complement them with objective assessments evaluating nurses' practical skills in GCS assessments. This evaluation could involve simulations or standardized patient scenarios.

9. Acknowledgment

The researchers acknowledge the commitment of all the nurses working in neuro wards of the University of Benin Teaching Hospital and Irua Specialist Teaching Hospital.

10. References

Ahamed, N., & Dutta, S. (2016). Effectiveness of planned teaching program on nurses knowledge and practice regarding Glasgow Coma Scale for neurological clients of a selected hospital, Kolkata. *Sikkim Manipal University Medical Journal, 3*(1), 2349 – 1604

Adogu, P. O. U., Egenti, N. B., Ubajaka C. F., Anakwue J. C., & Ugezu A. I. (2015). Epidemiological pattern and outcome of head injuries during festive and non-festive periods in a tertiary hospital, Nnewi, Nigeria. *International Journal of Research in Medical Sciences, 3*(10), 2718–2724. http://dx.doi.org/10.18203/2320-6012.ijrms20150683

Alhassan, A., Fuseini, A., & Musah, A. (2019). Knowledge of the Glasgow Coma Scale among nurses in a tertiary hospital in Ghana. *Nursing Research and Practice, 2019.* https://doi.org/10.1155/2019/5829028

Ann-Charlotte, F. (2015). Educational intervention to improve nursing practice in the critical care setting. *International Archives of Nursing and Health Care;* 1: 002

Ayoub, A. Y., Saifan, A., Alaween, M., Almansouri, E. A., Hussain, H. Y., & Salim, N. A. (2018). Assessment of nurse's knowledge about Glasgow Coma Scale at al Dhafra Hospitals, Abu Dhabi, United Arab Emirates 2018. *Journal of Clinical Review and Case Report, 3*(7), 1- 5

Derue, D. S., Nahrgang, J. D., Hollenbeck, J. R., & Workman, K. (2012). A quasi-experimental study of after-event reviews and leadership development. *The Journal of Applied Psychology, 97*(5), 997–1015. https://doi.org/10.1037/a0028244

Dongo, A. E., Kesieme, E. B., Eighemherio, A., Nwokike, O., Esezobor, E., & Alufohai, E. (2013). Motorcycle related injuries among rural dwellers in Irrua Nigeria: Characteristic and correlates. *Emergency Medicine International,* 2013. http://dx.doi.org/10.1155/2013/569103.

Elhagga, & Eldesouky, (2016). Impact of an educational program for nurses' knowledge and practice about Glasgow Coma Scale. *International Journal of Recent Scientific Research Research, 7*(3), 9690-9695.Available Online at http://www.recentscientific.com

Ehwarieme, T. A., & Anarado, A. N. (2016). Nurses' knowledge of Glasgow Coma Scale in neurological assessment of patients in a selected tertiary hospital in Edo state, Nigeria. *African Journal of Nursing and Midwifery, 2016,18*(2), 74–86

Ehwarieme T. A., Anarado, A. N., Osianc E. A., & Nnahiwed, B. (2021). Clinical nurses knowledge, skills and learning needs about Glasgow coma scale for neurological patients' assessment in tertiary hospitals in Edo state, Nigeria: A mixed method study. *International Journal of Africa Nursing Sciences, 15*(1), 10032. https://doi.org/10.1016/j.ijans.2021.100321

Emejulu, J. K. C., Ekweogwu, C. O., & Nottidge, T. E. (2009). The burden of motorcycle-related neurotrauma in South-East Nigeria. *Journal of Clinical Medicine and Research, 1*(1), 013-017. Available online http://www.academicjournals.org/JCMR

Emejulu, J. K. C., Isiguzo, C. M., Agbasoga, C. E., & Ogbuagu, C. N. (2010). Traumatic Brain Injury in the Accident and Emergency Department of a Tertiary Hospital in Nigeria. *East and Central African Journal of Surgery*; *15*(2), 28-38.

Nnadi, M. O. N., Bankole, O. B., & Fente, B. G. (2014). Epidemiology and treatment outcome of head injury in children: A prospective study. *Journal of Pediatric Neurosciences*, *9*(3), 237–241. https://doi.org/10.4103/1817-1745.147577

Geraghty, M. (2005). Nursing the unconscious patient. *Nursing Standard (Royal College of Nursing, Great Britain), 20*(1), 54–64. https://doi.org/10.7748/ns.20.1.54.s57

Huff, J. S., Stevens, R. D., Weingart, S. D., & Smith, W. S. (2012). Emergency neurological life support: Approach to the patient with coma. Neurocritical Care, *17*(Suppl 1), S54-S59. https://doi.org/10.1007/s12028-012-9755-4

Hussein, H. A. (2015). Effect of instructional guidelines about coma and pediatric Glasgow Coma Scale on knowledge and skills of pediatric intensive care nurses. *World Journal of Nursing Sciences, 1*(1), 01-12, DOI: 10.5829/idosi.wjns.2015.1.1.93200

Jasper, U. S., Opara, M. C., Pyiki, E. B., & Akinrolie, O. (2014). The Epidemiology of hospital-referred head injury in Northern Nigeria. *Journal of Scientific Research & Reports, 3(15), 2055-2064. https://doi.org/*10.9734/JSRR/2014/9645

Kamothi, A. (2016). A study to assess the effectiveness of a planned teaching programme on Glasgow Coma Scale of head injury patient in terms of knowledge and practice among staff nurses working in intensive care units of selected government medical college attached hospitals of Gujarat State. *International Journal of Novel Research in Healthcare and Nursing,* 3(2), 210–211. Available at: www.noveltyjournals.com

Kaur, H., Basauhra Singh, H. K., Chong, M. C., Thambinayagam, H. C., BinZakaria, M. I., Cheng, S. T., Tang, L. Y., & Azahar, N. H. (2016). Assessing nurses' knowledge of Glasgow Coma Scale in emergency and outpatient department. *Nursing Research and Practice, 2016.* http://dx.doi.org/10.1155/2016/8056350

Kimboka, J. J. (2017). Nurses' knowledge and practice in the application of the Glasgow Coma Scale in the intensive care units and emergency department at Muhimbili National Hospital and Muhimbili Orthopaedic Institute in Dar es Salaam. A Dissertation submitted in (Partial) Fulfillment of the Requirement for the Degree of Master of Nursing

(Critical Care and Trauma) of Muhimbili University of Health and Allied Sciences.

Kumar, S. (2015). Effectiveness of self-instructional module (sim) on knowledge regarding care of head injury patients among staff nurses working in selected hospitals, Punjab. *International Journal of Pharmaceutical Sciences Review and Research, 35*(2), 191–194.

Teles, M., Bhupali, P., & Madhale, M., (2013). Effectiveness of self instructional module on knowledge and skills regarding use of Glasgow Coma Scale in neurological assessment of patients among nurses working in critical care units of KLE Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum KLE University's Institute of Nursing Sciences, Nehrunagar, Belgaum. *Journal of Krishna Institute of Medical Sciences University* 2(1), 98-104

Mohammed, W. K., Abbas, A. D., & Jaddoua, B. A. (2013). Assessment of nurse's knowledge concerning Glasgow Coma Scale in neurosurgical wards. *Kufa Journal for Nursing Sciences*, *3*(2), 117–126. https://doi.org/10.36321/kjns.vi20132.2486

Hien, T. H., & Sun-Mi C. (2011). The accuracy of Glasgow Coma Scale knowledge and performance among Vietnamese Nurses *Perspectives in Nursing Science*, *8*(1), 54-61, http://119.82.96.198:8080/jspui/bitstream/

Ogunfowokan, A. A., Olaogun, A. A., & Okorodudu, T. U. (2010). Evaluation of clinical nurses' use of Glasgow Coma Scale in selected teaching Hospital in Osun State Nigeria. *West African Journal of Nursing, 21*(2), 87-92.

O'Farrell, B., & Zou, Y. G. (2008). Implementation of the Canadian Neurological Scale on an acute care neuroscience unit: A program evaluation. *Journal of Neuroscience Nursing*, *40*(4), 201-211

Oyedele, E. A., Emmannuel, A., Gimba, S., Rifkatu, L., & Stephen, N. (2015). The prevalence of traumatic head injury seen in a tertiary health facility in North-Central Nigeria. *International Journal of Public Health Research*, *3*(4), 127-129. 2015 (http://www.openscienceonline.com/journal/ijphr)

Polit, D.F., & Beck, C.T. (2014). *Essentials of nursing research: Appraising evidence for nursing practice*. 8th ed. Philadelphia: Wolters Kluwer/Lippincott/Williams & Wilkins Health.

Santos, W. C., Vancini-Campanharo, C. R., Lopes, M. C., Okuno, M. F., & Batista, R. E. (2016). Assessment of nurse's knowledge about Glasgow Coma Scale at a university hospital, *Einstein (Sao Paulo, Brazil)*, *14*(2), 213–218. https://doi.org/10.1590/S1679-45082016AO3618

Teasdale, G., Maas, A., Lecky, F., Manley, G., Stocchetti, N., & Murray, G. (2014). The Glasgow Coma Scale at 40 years: Standing the test of time. *The Lancet Neurology*, *13*(8), 844–854. https://doi.org/10.1016/S1474-4422(14)70120-6

Udoh, D. O., & Adeyemo, A. A., (2013). Traumatic brain injuries in children: A hospital-based study in Nigeria. *African Journal of Paediatric Surgery*, *10*(2), 154-9 https://doi.org/10.4103/0189-6725.115043

Vink, P., Tulek, Z., Gillis, K., Jönsson, A., Buhagiar, J., Waterhouse, C., & Poulsen, I. (2018). Consciousness assessment: A questionnaire of current neuroscience nursing practice in Europe. *Journal of Clinical Nursing*, *27*(21-22), 3913–3919. https://doi.org/10.1111/jocn.14614

Wong, D. L., & Hockenberry, M. J. (2011). *Nursing care of infants and children*. 7 ed., St. th Louis: MosbyCo. Pp. 984-988.

World Health Organization WHO (2013). Global Health Estimates Summary Tables: Projection of Deaths by Cause, Age, and Sex; Available at: http://ww.who.int/healthinfo/global_burden_disease/ projections/en/.

Waterhouse, C. (2008). An audit of nurse's conduct and recording of observation using the Glasgow Coma Scale. *British Journal of Neuroscience Nursing*, *4*(10), 492–99. https://doi.org/10.12968/bjnn.2008.4.10.31343