Effect of training sessions about Full Outline of Un-Responsiveness scale compared to Glasgow Coma Scale on nurses' performance, perception and its reliability

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Abstract

Background: Assessing patients' level of consciousness in intensive care units (ICUs) through Full Outline of Un-Responsiveness (FOUR) scale versus the Glasgow Coma Scale (GCS) requires critical care nurses' (CCNs) knowledge and skills to detect deterioration of patients' level of consciousness. **Objectives:** To evaluate the effect of implementing training sessionson critical care nurses' performance and perception regarding FOUR scale compared to GCS and reliability of each one. **Research hypotheses:** Nurses who attend training sessions willshow a significant improvement in performance of FOUR scale compared to GCS. **Study design:** A pretest posttest study design was used in this study. Method: The study was conducted at seven ICUs at Alexandria Main University Hospital including; Unit I, Unit II, Unit III, Medical, Respiratory, Neurosurgery, and Emergency anesthesia ICUs. **Subject: A convenient sampling** technique of all CCNs (100) and a purposive sample of adult critically ill patients equivalent to the number of nurses' sample was used to recruit the participants from previously mentioned CCUs. **Results:** The implemented training sessions were significantly effective in increasing CCNs' performance and positive perception of FOUR scale compared to GCS. There was overall higher inter-rater reliability regarding FOUR score than that of GCS score Cohen's kappa (0.92 versus 0.81) and 83% of nurses agreed that FOUR scale is a preferred scale to assess the depth of coma. **Conclusion:** training sessionswere significantly effective in increasing CCNs' performance and positive perception regarding FOUR scale compared to GCS. **Recommendation:** Nursing administrators should provide continuous training sessions. Manual for procedures is advised to be distributed to all CCNs including all methods for assessing patients' level of consciousness (LOC).

Keywords: Training sessions, Critical care nurses, performance, perception, reliability, Full outline of un-responsiveness scale, Glasgow coma scale.

Introduction

Alteration in LOC is a common acute medical problem frequently confronted the health care providers in both casualty and ICUs, whereas nearly 5% to 9% of patients admitted to the emergency department experienced various LOC alterations (Han & Wilber, 2013; Horsting, et al., 2015). Moreover, LOC is appraised on a continuum starts with full cognition and alertness and ends with coma. However, coma is a clinical state of unconsciousness in which the patient is unaware of self, time and the environment for prolonged periods (Smeltzer et al., 2010).

Altered LOC classified according to the duration and the degree of patients' response to external stimuli into; minimally conscious state, persistent vegetative state, locked-in syndrome, and coma (Bender, et al., 2015 & Puggina, et al., 2012). Therefore, the critical care nurses (CCNs) should rely on appropriate and accurate method in order to identify the exact LOC alteration, which act as cornerstone for future clinical decision making of patients' intervention and management.

Furthermore, neurological disorders encounter a tremendous challenge for the nurses when caring for critically ill patients (Jayalakshmi& Vooturi, 2016). Whenever there is an acute brain insult, from either traumatic brain injury (TBI) or non-traumatic injury such as; stroke, poisoning, infections or metabolic disorders, there is an immediate necessity to assess the degree of brain dysfunction. Moreover, the LOC and responsiveness are the most important indicators of the patient's condition (Bernat, 2010 & Bryan J, 2005), whereas, a decreased LOC is characteristic of nervous system dysfunction and is associated with increased morbidity and mortality.

Despite technology advances within the critical care settings, an accurate clinical assessment is still a key component to identify subtle changes in a patients' neurological status and is fundamental to their management. Therefore, in order to provide high quality patient care, the bedside nurse must be able to accurately and consistently assess and communicate these changes which provide an early indication of the patients' outcome (Kim, et al., 2012).

Over the past four decades since the initiation of the Glasgow coma scale (GCS), it is still remaining the most common universally used coma scale to identify the LOC. Initially the GCS was designed for patients with head injuries (Teasdale & Bryan, 1974) and accepted as an instrument to classify the severity of TBI as a result of its simplicity and consistency. The scale was adopted to improve health care providers' communication by offering a common language to evaluate the level and duration as well as the depth of disturbed consciousness and coma (Fischer, et al., 2010). Despite GCS worldwide publicity, it confronted some obstacles and deficiencies include; non-consistent of inter-rater reliability, non-applicability of verbal response assessment among the intubated patients, and non-applicability of verbal response assessment in numerous situations encompass; patients on paralyzing agents or sedatives and spinal cord injury (Jalali & Rezaei, 2014; Mercy, et al., 2013).

Till the time when Wijdicks and co-researchers (2005) established the Full Outline of Un-Responsiveness (FOUR) scale as an innovative coma scale to assess the depth of coma and to overcome the GCS deficiencies. Furthermore, FOUR scale was implemented among numerous patients' society in various specialized units encompass; medical, neurological, or pediatric ICUs as well as emergency settings (Bruno, et al., 2011; Iyer et al., 2009; Sadaka, et al., 2012; Stead, et al., 2009; Tadrisi, et al., 2012). FOUR scale consisted of four components include; eye response and motor response similar to GCS in addition to brainstem reflexes and respiration pattern to provide a brief snap shot of the patients neurological status , also it bypassed the patients' verbal response to overcome the GCS limitations (Wijdicks, et al., 2005).

In the era of advanced technology in the critical care settings, the CCNs depend on advanced monitoring machines but still in need to rely on their assessment skills as well as

accurate assessment tools with no limitation to monitor the patients' status (Hughes, 2008). Since CCNs play a pivotal role in assessing as well as interpreting the LOC of critically ill patients (McNett & Gianakis, 2010; Summers, et al., 2009), which consequently interferes with planning and implementing appropriate patient care with further impact on patients' outcomes (Watson, 2006; Wuchner, et al., 2012). Therefore, this study conducted to evaluate the impact of training sessionson nurses' performance, perception and the reliability of the FOUR scale compared to the GCS at Alexandria Main University Hospital.

Research hypothesis

− Nurses who attend the training sessionsshow an improvement in performance and perceptionregarding FOUR scale compared to GCS.

− The inter-rater reliability ofFOUR scale will be higher than GCS among CCNs.

Aim of the study

− Evaluate effect of training sessions about Full Outline of Un-Responsiveness scale compared to Glasgow Coma Scale on nurses' performance, perception and its reliability.

− Evaluate the impact of implementing training sessionson CCNs' performance and perception regarding FOUR scale compared to GCS at Alexandria Main University Hospital.

− Compare between the inter-rater reliability of CCNs' ratings of the GCS and the FOUR scale at Alexandria Main University Hospital.

Research methods

Research design:

Pretest posttest study design was used to achieve the aim of the current study.

Setting:

The study was conducted at seven Critical Care Units (CCUs) at Alexandria Main University Hospital including; Unit I, Unit II, Unit III, Medical ICU, Respiratory ICU, Neurosurgery ICU, and Emergency anesthesia ICU.

Sample:

Two samples were used to conduct the current study as follows;

The first sample was nurses' sample that included a convenient sample of all CCNs enrolled in the previously mentioned settings and willing to participate in the study. The current population of CCNs working in these CCUs was around 100 nurses.

The second sample was patients' sample that included a purposive sample of adult critically ill patients equivalent to the number of nurses' sample, newly admitted in the

previously mentioned settings with disturbed consciousness and available at the time of data collection. While, patients who received hypnotic, narcotic or neuromuscular relaxant medications and patients with hearing impairment, paraplegia and quadriplegia before ICU hospitalization were excluded from the study.

Tools:

Three tools were used for data collection as follows;

Tool one titled "Nurses' Knowledge and Practice of Consciousness Assessment". Part I & III were developed by the researcher after reviewing the related literatures (Smeltzer, et al., 2010 & Wijdicks et al., 2005) while part II was adopted from (Wijdicks, et al., 2005; Teasdale & Bryan J 1974). This tool was used to evaluate nurses' knowledge and practice about FOUR and GCS (Pre-post knowledge questionnaire and observational checklist). It comprised three parts including; Part I for nurses' characteristics included; age, gender, qualification, years of experience, working area, and previous training about FOUR and/ or GCS. Part II for observation of nurses' practice regarding both FOUR and GCS. It consisted of three items observational checklist for GCS (eye opening, verbal and motor functioning) and four items observational checklist for FOUR scale (Eye response, Motor response, Brainstem reflexes and Respiration). Each category was performed completely/accurately is graded as 1 point and zero point for incorrect or incomplete performance. Part III for assessment of nurses' knowledge that encompassed questions related to CCNs' knowledge about both FOUR and GCS and consisted of; (definition, indications, components, scoring methods, limitations, rational for using scale and how to assess it). The questions were similar in both pre-test and post-test with total score of each test out of ten whereas the respondents got one point for each correct answer and zero for incorrect one. The total scores of the items were summed up and converted into a percent score. The total score of 75% and more was considered good in knowledge and scores between 60% - 74% was considered fair while score less than 60% was considered poor knowledge.

Furthermore, tool two titled "LOC Assessment Checklist" that was used to evaluate the patients' LOC through Four scale and GCS. It's composed of two parts. The first part namely FOUR scale ", this scale was adopted from (Wijdicks, et al., 2005). It was used to measure the LOC provided, it provided a comprehensive and accurate snapshot of patient's neurological status. It composed of four functional categories: eye response, motor response, brainstem reflexes, and respiration. Each of these categories assigned a value of 0 to 4, a score of 0 indicating nonfunctioning status, and a score of 4 indicating normal functioning. That is why the FOUR score ranged between zero and 16. The second part namely "GCS", this Scale was adopted from Teasdale & Bryan J (1974). It was used to identify the patients' LOC. It consisted of 4 graded items; eye opening (from 1 to 4 score), motor response (from 1 to 6 score), and verbal response (from 1 to 5 score). The highest score of the GCS is 15 and the lowest score is 3. The total score for GCS was summed and classified as mild from 13–15, moderate from 9–12 and severe from 3–8.

In addition to patients' profile data form, that was developed by the researcher to assess patient's characteristics. It contains patient's age, gender, admission diagnosis, and the current coma scores of both GCS and FOUR scale as assessed by the researchers.

Finally, tool three titled "Nurses' Perception of both GCS and FOUR scale Questionnaire", that was developed by the researcher after reviewing the related literatures (Mercy et al., 2013 & Teasdale & Bryan J, 1974) and was used to assess nurses' perceptions regarding both GCS and FOUR scale. It was divided in to two parts each one will comprise 7 items to assess the nurses' perception of the GCS and FOUR scale. All items were rated on a 5-point Likert scale varying from 1 for strongly disagree to 5 for strongly agree.

Description of interventions

A pilot study was carried out after the development of the tools. It was carried out on 10 patients and 10 nurses working at CCUs to test the reliability and applicability of the tools of the study. The necessary modifications were done based on the results of the pilot study. Those patients and nurses were excluded from the study's subjects.

The study was conducted in three phases as follows; the first phase was the preparatory phase to assess nurses' performance through observational checklist utilizing part II of tool one and the CCNs' knowledge regarding both GCS and FOUR scale through questionnaire using part III of tool one. The CCNs were observed for assessing both GCS and Four scale firstly prior to the pretest and training session. Then the researcher distributed the pretest questionnaire using part III of tool one to each nurse on individual base during her/his break time to test their baseline knowledge regarding both GCS and FOUR scale. The second phase was the process phase, whereas the nurses' sample was divided in to seven groups in relation to the nurses' current working settings in hospital. Then the researchers conducted the training sessionsregarding both GCS and FOUR scale for each group of nurses. The training sessions were implemented intermittently over three hours duration per each group and included; power point presentation, interactive session, lecture handout, video show, and application on patients to assess the LOC using tool two.

Furthermore, the third and final phase was the evaluation phase, whereas the conducted training sessions'outcomes were evaluated using tools one and two. Then the researchers reevaluated nurses' performance regarding both FOUR scale and GCS using part II of tool one. The researcher reevaluated also post-test knowledge to all nurses at the end of three-hours training sessions using part III of tool one. After that, the researchers reassessed each patient for their characteristics and the actual LOC by both FOUR scale and GCS using tool two as a validation method after nurse's previous assessment for the same patients. Finally, at the end of data collection, all studied nurses' sample completed a self-reported questionnaire on their perception regarding both GCS and FOUR scale using tool three. Each nurse was given from 10 to15 minutes to answer this questionnaire.

Ethical considerations

A permission to conduct the study was obtained from the responsible authorities after explanation of its purpose. Then after explaining the purpose and importance of the study to all participants; each nurse as well as a significant family member of each patient, signed a consent form indicating their willingness to participate in the study including their right to withdraw from the study at any time. And confidentiality of the information was ascertained by the researcher.

Results

Table (I) presents frequency and percentage distribution of the studied nurses according to their characteristics. It was found that more than half (57%) of the studied nurses were in the age group of 30 years to less than 40 years. The majority of them (92%) were female and more than half of them were married. Regarding their qualifications, nearly half of them (53%) had diploma in nursing while only 16% had a bachelor's degree of nursing. In relation to working experience in the ICU, it was found that 36% of nurses had 10 years to less than 15 years of experience while only 10% had more than 20 years of experience. On the other hand, the majority of nurses did not receive any previous training about GCS and FOUR scale (82%) and (95%) respectively.

Table (II) presents frequency and percentagedistribution of patients according to their clinical related data. In relation to patients' age, about half of them were >60 years (48%) and about three quarter of them were males (74%). Regarding their diagnosis, it was found that more than one third of patients (41%) were admitted with respiratory disorder. As regard presence of tracheal tube, the majority of patients (87%) were intubated. In relation to current LOC, it was found that less than two thirds of patients (59%) scored from 9-13 by assessing GCS compared with the majority of patients (91%) scored from 9-16 by using FOUR scale.

Table (III) presents frequency and percentagedistribution of studied nurses regarding their knowledge about GCS and FOUR scale before and after training sessions. It was found that only half of nurses knew definition, indication, components, scoring range, limitations, rational for using GCS score and how to assess it before training sessionswith a mean of 52.5±13.43 compared to a mean of 84.4±7.90 after training sessions. Regarding their knowledge about FOUR scale, it was found that few of nurses knew definition, indication, components, scoring range, limitations, rational for using FOUR scale and how to assess it with a mean of 8.1±5.54 compared to a mean of 90.1±4.87 after training sessions.

Table (IV) presents frequency and percentagedistribution of studied nurses regarding their practiceabout GCS and FOUR scale before and after training sessions. It was found that the majority of nurses performed GCS correctly after training sessions rather than before with statistically significance value (p=0.03). Regarding their practice about FOUR scale, it was found that nearly all nurses had higher significant improvement (p<0.001) in their performance of all components of FOUR scale after training session (96%, 97%, 91%,94%) rather than before (11%,7%,13%,9%).

Table (V) Presented total mean percentage score of the studied nurses' knowledge and practices about GCS and FOUR scale after training session. A statistically significant differences (p=0.002) were found regarding only nurses' practices of FOUR scale compared to their practices of GCS after training session. The majority of nurses (87%) had good performance of FOUR scale while, about half of them (54%) had good performance of GCS.

Table (VI) presents inter-rater reliability (agreement) of assessment of both GCS score and FOUR scale. Inter-rater reliability was assessed by the researcher and nurses and analyzed using Cohen's kappa and inter-rater correlation coefficients. The overall inter-rater agreement regarding FOUR score was higher (Cohen's kappa, 0.92 for both the researcher

and nurses) than that of GCS score (Cohen's kappa, 0.81 for both the researcher and nurses)

Table (VII) presents frequency and percentage distribution of studied nurses according to their perception of both GCS and FOUR scale. Around three quarter of nurses (81%), (76%), (78%), (83%),(78%), (72%) & (78%) respectively agreed that FOUR scale gives detailed clinical information regarding patient's LOC, easy to use, takes less time to perform, is a preferred scale to assess the depth of coma, is a preferred scale to predict the patient outcomes, accurately reflects the actual patient's LOC and is a coma assessment tool applicable for all patients with no limitation. On the other hand, their perception of GCS, it was found that about two thirds of them (72%) & (71%) respectively agreed that GCS score is easy to use and takes less time to perform. Around two thirds of them (64%) & (61%) respectively agreed that GCS gives detailed clinical information regarding patient's LOC and is a preferred scale to assess the depth of coma and half of them (47%), (49%), (52%) respectively agreed that GCS is a preferred scale to predict the patient outcome, accurately reflects the actual patient's LOC and is a coma assessment tool applicable for all patients with no limitation.

Table (VIII) presents relationship between nurses' knowledge and practice of GCS score and FOUR scale with their characteristics. Regarding relationship between nurses' level of knowledge of GCS & their characteristics, there was a statistical significance relation regarding nurses' gender (p=0.041), qualifications (p= 0.02), and previous training of GCS (p= 0.03). In relation to nurses' knowledge of FOUR scale with their characteristics, it was found that the nurses with age from 20 - <30 years had a higher level of knowledge than others (p=0.01). Regarding qualifications, the nurses who hold bachelor's degree had higher level of knowledge (p=0.001) than other qualifications. In relation to ICU work of experience, the nurses with work experience from 1 - <5 years had significantly higher knowledge (p=0.01) than others. Nurses with previous training about FOUR scale had significantly higher level of knowledge than who didn't have training (P=0.01). Regarding relationship between nurses' practice of GCS versus FOUR scale with their characteristics, it was found that there were significant relationship regarding only their qualification and ICU work experience. The nurses who hold bachelor's degree had higher level of practice (p=0.001) than other qualifications. In relation to ICU work of experience, the nurses with work experience from 1 - <5 years had significantly higher practice level (p=0.01) than others.

Table (I): Frequency and percentage distribution of the studied nurses according to their characteristics (n=100).

Nurses characteristics	No. (n=100)	%
Age		
20 - <30 years	31	31%
30 - <40 years	57	57%
40 - 50 years	12	12%
Sex		
Male	8	8%
Female	92	92%
Marital status		
Married	45	45%
Unmarried	55	55%
Qualification		
Diploma	53	53%
Technical	31	31%
Bachelor	16	16%
ICU work experience		
1 - <5 years	18	18%
5 - <10 years	18	18%
10 - <15 years	36	36%
15 - 20 years	18	18%
> 20 years	10	10%
Current workplace		
Unit I	22	22%
Unit II	12	12%
Unit III	15	15%
Medical ICU	17	17%
Respiratory ICU	12	12%
Neurosurgery ICU	12	12%
Emergency anesthesia ICU	10	10%
Previous training about GCS		
Yes	18	18%
No	82	82%
Previous training about FOUR		
Yes	5	5%
No	95	95%

ICU: intensive care unit; GCS: Glasgow coma scale; FOUR: Full Outline of Unresponsiveness.

Table (II): Frequency and percentage distribution of the patients according to their clinical related data (n=100).

Patients' clinical related data	No. (n=100)	%
Age		
20- 40	15	15%
41 – 50	16	16%
51 – 60	21	21%
61- 70	48	48%
Gender		
Male	74	74%
Female	26	26%
Admission diagnosis		
Traumatic	22	22%
Cardiovascular	16	16%
Respiratory	41	41%
Renal	9	9%
Gastrointestinal	3	3%
Neurological	5	5%
Endocrinal	2	2%
Poisoning	2	2%
Presence of ETT/TT		
Yes	87	87%
No	13	13%
Current patient LOC using GCS		
3-8	17	17%
9-12	59	59%
13-15	24	24%
Current patient LOC using FOUR scale		
0-8	9	9%
9-16	91	91%

ETT: endotracheal tube; TT: tracheostomy tube; GCS: Glasgow coma scale; FOUR: Full Outline of Unresponsiveness.

Table (III): Frequency and percentage distribution of the studied nurses regarding their knowledge about GCS and FOUR scale before and immediately after training sessions(n=100).

Nurses' knowledge assessment parameters	GCS				Test of significance	FOUR				Test of significance
	Pre-test (n=100)		Post-test (n=100)			Pre-test (n=100)		Post-test (n=100)		
	Yes No. (%)	No No. (%)	Yes No. (%)	No No. (%)		Yes No. (%)	No No. (%)	Yes No. (%)	No No. (%)	
Definition	77 (77%)	23 (23%)	89 (89%)	11 (11%)	X^2= 0.23 P= 0.09	11 (11%)	89 (89%)	93 (93%)	7 (7%)	X^2= 11.23 P= <0.001*
Indications	73 (73%)	27 (27%)	92 (92%)	8 (8%)	X^2= 0.69 P= 0.10	19 (19%)	81 (81%)	86 (86%)	14 (14%)	X^2= 12.79 P= <0.001*
Components	57 (57%)	43 (43%)	89 (89%)	11 (11%)	X^2= 0.54 P= 0.11	9 (9%)	91 (91%)	91 (91%)	9 (9%)	X^2= 65.35 P= <0.001*
Scoring range	46 (46%)	54 (54%)	84 (84%)	16 (16%)	X^2= 0.69 P= 0.08	6 (6%)	94 (94%)	89 (89%)	11 (11%)	X^2= 23.64 P= <0.001*
Limitations	31 (31%)	69 (69%)	71 (71%)	29 (29%)	X^2= 0.64 P= 0.21	3 (3%)	97 (97%)	82 (82%)	18 (18%)	X^2= 24.28 P= <0.001*
Rational of using score	53 (53%)	47 (47%)	86 (86%)	14 (14%)	X^2= 0.79 P= 0.09	5 (5%)	95 (95%)	96 (96%)	4 (4%)	X^2= 6.62 P= <0.001*
How to assess score	31 (31%)	69 (69%)	94 (94%)	6 (6%)	X^2= 0.89 P= 0.07	4 (4%)	96 (96%)	94 (94%)	6 (6%)	X^2= 21.86 P= <0.001*
Total mean score	52.5±13.43		84.4±7.90		t= 5.69 P= 0.04*	8.1±5.54		90.1±4.87		t= 25.69 P= <0.001*

 GCS: Glasgow coma scale; FOUR: Full Outline of Unresponsiveness; Statistically significant at p ≤ 0.05.

Table (IV): Frequency and percentage distribution of the studied nurses regarding their practice about GCS and FOUR scalebefore and immediately after training sessions(n=100).

Level of Consciousness Items		Nurses' practice before (n=100)		Test of significance	Nurses' practice after (n=100)		Test of significance
		Correct No. (%)	Incorrect No. (%)		Correct No. (%)	Incorrect No. (%)	
GCS	Eye opening	30(30%)	70(70%)	X^2= 0.54 P^{MC}= 0.11	65(65%)	35(35%)	X^2= 16.53 P^{MC}= 0.03*
	Verbal response	25(25%)	75 (75%)		87(87%)	13(13%)	
	Motor response	63(63%)	37(37%)		89(89%)	11(11%)	
FOUR scale	Eye response	11(11%)	89(89%)	X^2= 0.83 P^{MC}= 0.08	96(96%)	4(4%)	X^2= 31.41 P^{MC}= <0.001*
	Motor response	7(7%)	93 (93%)		97(97%)	3(3%)	
	Brainstem reflexes	13(13%)	87(87%)		91(91%)	9(9%)	
	Respiration	9(9%)	91(91%)		94(94%)	6(6%)	
Total		t=0.098 p= 0.850			t= 3.789 P=0.000*		

 GCS: Glasgow coma scale; FOUR: Full Outline of Unresponsiveness; C: Correct; IC: incorrect; Statistically significant at p ≤ 0.05.

Table (V): Total mean percentage score of the studied nurses' knowledge and practices about GCS and FOUR scale after training session (n=100).

knowledge and practices		Level of knowledge and practices (n=100)			Significance Test
		Good	**Fair**	**Poor**	
		No. (%)	**No. (%)**	**No. (%)**	
Knowledge	**GCS**	60(60%)	26(26%)	14(14%)	X^2= 19.203
	FOUR scale	62(62%)	24(24%)	14(14%)	p= 0.396
Practices	**GCS**	54(54%)	32(32%)	14(14%)	X^2=9.197
	FOUR scale	87(87%)	9(9%)	4(4%)	p= 0.002*

LOC: level of consciousness; GCS: Glasgow coma scale; FOUR: Full Outline of Unresponsiveness; Statistically significant at p ≤ 0.05.

Table (VI): Inter-rater reliability (agreement) of assessment of both GCS score and FOUR score (n=100).

Variables	K	ICC
Total GCS score	0.81	0.94
Eye	0.72	0.88
Verbal	0.85	0.92
Motor	0.85	0.88
Total FOUR score	0.92	0.95
Eye	0.90	0.85
Respiration	0.99	0.94
Brainstem reflexes	0.88	0.93
Motor	0.95	0.92

GCS: Glasgow coma scale; FOUR: Full Outline of Unresponsiveness; K: Cohen's kappa; ICC: inter-rater correlation coefficients.

Table (VII): Frequency and percentage distribution of nurses according to their perception of both GCS and FOUR scale(n=100).

Nurses' perception of coma scales	GCS (n=100)			FOUR scale(n=100)		
	Agree No. (%)	**Neutral** No. (%)	**Disagree** No. (%)	**Agree** No. (%)	**Neutral** No. (%)	**Disagree** No. (%)
It provides detailed clinical information regarding patient's LOC.	64 (64%)	4 (4%)	32 (32%)	81 (81%)	7 (7%)	2 (2%)
It is easy to use.	72 (72%)	7 (7%)	21 (21%)	76 (76%)	21 (21%)	3 (3%)
It takes less time to perform	71 (71%)	9 (9%)	20 (20%)	78 (78%)	12 (12%)	10 (10%)
It is preferred tool to assess the depth of coma.	61 (61%)	11 (11%)	28 (28%)	83 (83%)	11 (11%)	6 (6%)
It is preferred tool to predict the patient outcome.	47 (47%)	13 (13%)	40 (40%)	78 (78%)	14 (14%)	8 (8%)
It is accurately reflecting the actual patient's LOC.	49 (49%)	17 (17%)	34 (34%)	72 (72%)	22 (22%)	6 (6%)
It is a coma assessment tool applicable for all patients with no limitation.	52 (52%)	9 (9%)	39 (39%)	78 (78%)	12 (12%)	10 (10%)

LOC: level of consciousness; GCS: Glasgow coma scale; FOUR: Full Outline of Unresponsiveness.

Table (VIII): Relationship between nurses' knowledge and practices of GCS score and FOUR scalewith their characteristics (n=100).

Nurses characteristics	GCS knowledge Good	Poor	Sign. Test	FOUR knowledge Good	Poor	Sign. Test	GCS practice C	IC	Sign. Test	FOUR practice C	IC	Sign. Test
Age												
20 -<30 years	56%	44%	X2= 0.54 P= 0.60	88.7 %	11.3 %	X2= 5.74 P=0.01 *	51%	49%	X2= 0.50 P= 0.51	85.3 %	14.7 %	X2= 0.96 P=0.21
30 -<40 years	46.2 %	53.8 %		74.1 %	25.9 %		43.6 %	56.4 %		73.3 %	26.7 %	
40 - 50 years	44.3 %	55.7 %		46.7 %	53.3 %		42.1 %	57.9 %		49.9 %	51.1 %	
Sex												
Male	60.5 %	39.5 %	X2=31. 54 P=0.041 *	84.3 %	15.7 %	X2= 0.97 P=0.23	59.4 %	40.6 %	X2=28. 61 P=0. 17	62.6 %	37.4 %	X2= 0.89 P=0.31
Female	44.3 %	55.7 %		69.6 %	30.4 %		43.6 %	55.7 %		87.6 %	12.4 %	
Marital status												
Married	54.1 %	45.9 %	X2= 1.78 P=0.39	66.9 %	33.1 %	X2=7. 54 P=0.13	49.2 %	50.8 %	X2= 1.64 P=0.32	58.3 %	41.7 %	X2=6. 32 P=0.17
Unmarried	59.6 %	40.4 %		59%	41%		61.8 %	30.2 %		53.1 %	46.9 %	
Qualification												
Diploma	24.4 %	75.6 %	X2= 32. P= 0.02*	44.1 %	55.9 %	X2= 0.24 P=0.00 1*	23.7 %	76.3 %	X2= 35 P= 0.01*	42%	58%	X2= 0.31 P=0.00 1*
Technical	50.1 %	49.9 %		81.9 %	18.1 %		53%	47%		78%	22%	
Bachelor	84.8 %	15.2 %		97.4 %	2.6 %		89%	11%		96.9 %	3.1 %	
ICU work experience												
1 - <5 years	19%	81%	X2= 3.51 P=0.67	94.4 %	5.6 %	X2= 0.94 P=0.01 *	21%	79%	X2= 4.01 P=0.74	94.9 %	5.1 %	X2= 1.23 P=0.01 *
5 - <10 years	59.4 %	40.6 %		92%	8%		51.9 %	48.1 %		82.2 %	17.8 %	
10 -<15 years	53.4 %	46.6 %		66.9 %	33.1 %		63%	37%		67.8 %	32.2 %	
15 - 20 years	52.9 %	47.1 %		57.7 %	42.3 %		56.2 %	43.8 %		49%	51%	
> 20 years	5.3 %	94.7 %		55.5 %	44.5 %		7.8 %	92.2 %		53%	47%	
Current workplace												
Unit I	67.9 %	32.1 %	X2= 5.53 P=0.35	76.4 %	23.6 %	X2= 0.78 P=0.22	73%	27%	X2= 4.98 P=0.29	76%	24%	X2= 0.69 P=0.21
Unit II	54.6 %	45.4 %		87.6 %	12.4 %		57.8 %	42.2 %		79.4 %	20.6 %	
Unit III	87%	13%		95.5 %	4.5 %		82.9 %	17.1 %		91.9 %	8.1 %	
Medical ICU	33%	67%		56.1 %	43.9 %		17%	83%		51%	49%	
Respiratory ICU	16.9 %	83.1 %		33%	67%		32%	68%		41.2 %	58.8 %	
Neurosurgery ICU	57%	43%		68%	32%		49%	51%		32.7 %	67.3 %	
Emergency anesthesia ICU	42%	58%		31%	69%		51%	49%		29.5 %	70.5 %	
Previous training												
Yes	66%	34%	X2=0.5 465 P=0.03*	82.8 %	17.2 %	X2= 9.54 P=0.01 *	56.8 %	43.2 %	X2=29. 56 P=0. 13	74.6 %	25.4 %	X2= 0.86 P=0.28
No	8.9 %	91.1 %		95%	5%		47.9 %	52.1 %		89%	11%	

GCS: Glasgow coma scale; FOUR: Full Outline of Unresponsiveness; ICU: intensive care unit; C: Correct; IC: incorrect; Statistically significant at p ≤ 0.05.

Discussion

Disturbed LOC is considered as a major problem among critically ill patients' population, that is why the CCNs must rely on an accurate, precise and limitation free assessment tool to evaluate the particular LOC and be applicable for all patients as well as to predict the prognosis of patients' condition which should guide the nurses for appropriate clinical decision making **(Irajpour, et al., 2014).**

Regarding nurses' knowledge about GCS and FOUR scale the current study revealed that the nurses were more knowledgeable about GCS compared to FOUR scale before conducting the training sessions, whereas the nurses routinely used GCS in all studied settings to assess the patients' LOC and the majority of nurses were unacquainted about FOUR scale. That is congruence with other researchers **(Albougami, 2019 and Chilikova & Dimitrov, 2016).** On the other hand, this study showed that CCNs were more knowledgeable about FOUR score compared to GCS after training session, which may be rationalized by the simplicity of conducting FOUR scale similarly to other researchers' findings **(Johnson & Whitcomb, 2013).** This was also supported by Sharma, et al., (2018) that revealed a significant effect of structured teaching programme regarding FOUR scale as the mean posttest knowledge were significantly higher than the pretest knowledge. The FOUR scale solved the deficiency of GCS among intubated patients whereas patients' verbal response was inapplicable **(Bruno, et al., 2011).**

The current study showed that about half of nurses had sufficient knowledge regarding definition, indication, components, scoring range,

limitations, rational of using GCS score and how to assess it compared to poor level of knowledge regarding FOUR scale before training sessions. That was supported by other researchers who found that near half of nurses had average knowledge about assessing LOC using GCS **(Santos, et al., 2016 & Teles, et al., 2013).** On the other hand, numerous researchers revealed that more than half of nurses working in emergency department had poor knowledge about method for assessing GCS and detecting patients' deterioration **(Alhassan, et al., 2019; Mattar, et al. 2015 & Singh, et al., 2016).** That may be due to lack of standards, poor quality of skills teaching and lack of continuing training programs especially for invoice nurses. Also, **Jaddoua et al. (2013)** showed that all nurses had inadequate knowledge about GCS. Furthermore, a descriptive study by **Eldesouky (2016)** investigated the reason for poor GCS knowledge among Egyptian nurses and reported that the nurses had less exposure to training sessionsabout the GCS. This may reflect the importance of continuous training session for nurses regarding assessment methods of LOC to improve patient care and continuous professional development of CCNs.

The current study revealed that the majority of nurses performed GCS correctly after training sessions rather than before. While, nearly all nurses had a higher significant improvement in their performance of all components of FOUR scale after training session rather than before. This was supported by Eldesouky (2016) that showed a higher improvement of nurses' practice of GCS immediate posttest than the pre-test. Also, **Ahamed, & Dutta (2016) and Nguyen & Sun-Mi (2011)** revealed that nurses' practice of GCS was significantly improved after the training program than before. Regarding the current study results of the higher nurses' performance of FOUR scale

compared to GCS after training session. This was supported by **Wolf, et al. (2007)** that revealed a higher nurses' performance of FOUR scale compared to GCS. This may be due to the specificity and simplicity of scoring system of FOUR scale.

The current study showed that the overall inter-rater agreement that was assessed by the researcher and nurses and analyzed using Cohen's kappa regarding FOUR scale was higher than that of GCS score. Which was supported by **Kevric (2011)** who evaluated inter-rater reliability using Cohen k and observed higher inter-rater reliability for the FOUR scale than that of GCS, that can be more useful in providing an overall assessment for the unconscious patients, unlike the GCS which may be not applicable intubated patients. Reliability was greater among experienced than inexperienced staff in FOUR scale but not in GCS. Consistently, the reliability for the total GCS and the FOUR scale were significantly lower than the sub components of both. This may indicate that adding up the components results in missing of some information the FOUR scale may be more useful in providing an overall assessment of the unconscious patient because unlike the GCS, it can be reliably used in the intubated patient. This was in agreement with **Wolf, et al., (2007)** that reported excellent inter-rater reliability of FOUR scale compared with the GCS. This can be related to incorporating simple daily neurologic tests to assess levels of unconsciousness. In addition, the study confirms that the FOUR scale can be a reliable method to be used by nurses with limited experience in the neuroscience ICU on similar patients. This can be related to incorporating simple daily neurologic tests to assess levels of unconsciousness. Also, study revealed little diminishing effect of inexperienced than experienced

nurses regarding GCS. This may be due to a consequence of teaching the GCS in nursing curriculum and its frequent use in ICUs and other areas of the hospital. Another similar result was reported by **Bruno, et al., (2011)** that recommended The FOUR scale as a valid tool with good inter-rater reliability that is comparable to the GCS.

The current study showed that the majority of nurses agreed that FOUR scale is a preferred scale to assess the depth of coma and gives detailed clinical information regarding patient's LOC, it's a preferred scale to predict the patient outcomes, easy to use, takes less time to perform, accurately reflects the actual patient's LOC and an applicable tool for all patients with no limitations. On the other hand, regarding nurses' perception of GCS, it was found that about two thirds of them agreed that GCS score is easy to use and takes less time to perform. More than half of them agreed that it gives detailed clinical information regarding patient's LOC and is a preferred scale to assess the depth of coma. But only half of them agreed that GCS can predict the patients' outcomes, accurately reflects the actual patient's LOC as a coma assessment tool applicable for all patients with no limitation. This was similar to **Kevric, et al., (2011)** in which most staff members felt that the FOUR scale was clinically relevant, readily obtainable and easy to use. Most of them felt that the GCS was difficult to apply in intubated patients and those on bi-level positive airway pressure. Although these findings indicate that the nursing staff are highly reliable in assessing patients using the FOUR scale, more than half of them preferred the GCS over the FOUR scale, this may be lack of familiarity with the indication of FOUR scale score. On the other hand, **Johnson & Whitcomb (2013)** concluded that nurses highly recommended the use of the

FOUR scale than the GCS to assess the neurological responsiveness of their patients with a higher rater agreement than the GCS.

The current study presented relation between nurses' knowledge of GCS score and FOUR scale scale with their characteristics. There was a statistical significance relation regarding nurses' qualifications, and previous training of GCS. Nurses who hold bachelor's degree had higher level of knowledge and practice than other qualifications. Also, nurses with work experience from 1 - <5 years had significantly higher knowledge and skills than others. Nurses with previous training about FOUR scale had significantly higher level of knowledge than who didn't have training. This was supported by Keykha, et al., (2017) & Mattar, et al., (2015) that showed a significant correlation between educational level, previous training and level of knowledge on GCs. Similarly, Chan & Matter (2013) & Santos, et al., (2016) illustrated that there were statistically significant relationship between nurses' level of education and practice on GCS. More experienced nurses had higher percentage of knowledge and practice, and also nurses from emergency unit were knowledgeable compared to ICU nurses. **Singh, et al., (2016), Al-Quraan**

&AbuRuz., (2016); Ehwarieme & Anarado., (2016) & Santos, et al., (2016) found that ER nurses and outpatient department with high educational attainment had higher knowledge about GCS. Also, **Abougami,. (2019**) found that nurses with postgraduate and bachelor degrees had more knowledge and skills than diploma nurses. In contrast, surprisingly, these researches showed that nurses without additional GCS training had more GCS knowledge than nurses with training. The current study was also contradicting with Alhassan, et al., (2019) that presented no statistically significant difference between nurses' level of training and years of experience with their knowledge on GCS.

The current study presented statistical relation between nurses' gender and their knowledge of GCS. Nurses with age from 20 - <30 years had a higher level of knowledge than others. This was supported by **Mattar, et al., (2015**) that showed a significant correlation between knowledge and age group. Mid age nurses had a higher knowledge and experience in GCS than other age groups. On the other hand, Singh, et al., (2016) showed that nurses in age group of 41–60 had a statistically significant higher level of knowledge compared to age group of 20–30. In contrast **WOLF, et al., (2007)** found that nurses' age was not significantly associated with nurses' level of knowledge regarding GCS.

Limitation of study

- Nurses' different educational backgrounds and training level may interfere with their assessment results.

- The sample was relatively small in size.

Conclusion

The implemented training sessionsin the current study was significantly effective in increasing CCNs' performance and positive performance. There was overall higher inter-rater reliability regarding FOUR scale than that of GCS score**.**

Recommendation

▪ Nursing administrators should provide continuous training sessions. Manual for procedures is advised to be distributed to all CCNs including all methods for assessing patients' LOC.

▪ A follow-up study should be conducted in a variety of hospitals, with a larger sample size to enhance generalizability.

▪ Implementing refresher trainings courses regularly to all CCNs as a part of continual education regarding methods for assessing GCS.

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No

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