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The Effectiveness of Training Sessions About Glasgow Coma Scale (GCS) And Full Outline of Un-Responsiveness Four Score on Jordanian ICU Nurses' Knowledge and Perception

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ABSTRACT: Background: Traumatic brain injury (TBI) is a public health issue and the leading cause of mortality and coma status. Glasgow Coma Scale (GCS) and Full Outline of Un-Responsiveness (FOUR) score are reliable coma tools for assessing the level of consciousness (LOC) among critically ill patients in intensive care unit (ICU). An assessment of LOC and depth of coma is considered the primary action of critical care nurses (CCN). Therefore, conducting a training sessions will help to improve ICU nurses' knowledge and perception of coma scales. **Aim:** This study aimed to assess the effectiveness of training sessions among Jordanian ICU nurses' knowledge and perception toward GCS and FOUR score. Methods: A one-group pretest–posttest experimental design was utilized to assess the effectiveness of training sessions on ICU nurses' knowledge and perception toward GCS and FOUR score. Total of 71 participants were recruited conveniently from five ICUs in five governmental hospitals. Data were collected by the researcher before the intervention, and immediately after the intervention was conducted using three tools to assess the socio-demographic characteristic, nurses' knowledge regarding GCS and FOUR score, and nurses' perception of GCS and FOUR score. **Results:** ICU nurses' knowledge of GCS and FOUR score significantly improved ($p<0.001$) after the intervention. Regarding nurses' perception, ICU nurses demonstrated a statistically significant improvement ($p<0.001$) in FOUR score. However, a significant ($p=0.034$) decrease in nurses' perceptions of GCS appeared after the intervention. **Conclusion:** This study emphasizes the importance of applying training sessions inside Jordanian ICUs settings to improve nurses' knowledge and perception regarding GCS and FOUR score, as this helps improve critically ill patients' outcomes and the quality of nursing care.

Keywords: Full Outline of Un-Responsiveness Scale, Glasgow Coma Scale, Knowledge, Nurses, Perception, Training Sessions.

INTRODUCTION

Consciousness is the state that helps us be aware of ourselves with the environment and wakefulness for any stimuli [18]. On the other hand, coma occurs when there is an absence of awareness of self and the environment even if the person stimulated with any external force [11]. Coma may occur for many reasons, including brain lesions, metabolic brain dysfunction, traumatic brain injury, and psychiatric [18].

Traumatic brain injury (TBI) is a type of wound that change brain function. TBI is a public health problem that affects people of all ages, irrespective of gender or other demographic factors [8]. More than 63 million individuals worldwide experience TBI each year, with the Western Pacific and Southeast Asia facing the highest total illness burden [8]. In the United State of America (USA), TBI is a leading cause of mortality and disability. In 2019, there were over 223 thousand hospitalizations for TBI in the USA that lead to change in level of consciousness (LOC) and coma. Moreover, in 2021, approximately 190 Americans died from TBI-related injuries per day [6].

According to El-Menyar et al. (2017) the Middle East countries like Jordan has a burden from traumatic brain injury (TBI), especially from trauma related to motor vehicle accidents (MVA). Head injuries resulting from MVA and fall are the main causes of coma [10]. According to Roy et al. (2019) [21], unconsciousness was the most common presenting symptom among the 300 patients of head injury studied. Regarding the MVA, the Jordanian *Public Security Directorate* (2021) [19] stated that the number of MVA during 2021 in Jordan was 11241, which led to more than 700 cases with severe injury that may lead to unconsciousness of the victims; these comatose cases should be diagnosed and treated.

Many neurological assessment tools have been designed to assess patients' levels of consciousness (LOC), one of which is the Glasgow Coma Scale (GCS). The GCS was first described by Jennett and Teasdale during the 1970s and was used to assess comatose patients by evaluate three levels of response: eye opening, verbal response, and the last level is motor response [11].

The GCS is effective neurological assessment tool as it is simple to assess and predict the neurological status and level of consciousness of patients [27]. In addition, it has become an important tool of the clinical setting and research [7]. GCS is useful in predicting symptoms and mortality in patients with brain injury, the score of GCS has three components: eye response (E4), verbal response (V5), and motor response (M6) [11]. The

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GCS may be extended to versions that help dealing with emerging situations [20].

A new coma scale was found, the Full Outline of Un-Responsiveness (FOUR) score, which is a coma scale that helps assess neurological status. The FOUR score has four components: eye response (E), motor response (M), brainstem reflexes (B), and respiration (R), for each category, the maximal grade was four (E4, M4, B4, R4). The scale had an excellent inter-rater agreement ($\kappa w = 0.82$) among critically ill patients [28].

In comparison with GCS, the categories of the FOUR score can be rated even if patients have undergone intubation. The FOUR score is useful predictor of health status among critically ill patients including comatose patients. In addition, the FOUR score showed more advantages over the GCS in the clinical setting, especially in ICUs [16]. For the advantages of FOUR score compared to GCS, Wijdicks et al., (2005) stated that the FOUR score provides more neurological status details, it identifies different stages of brain hernia, it help to detect the vegetative state, and it does not use a verbal response and thus may have a higher assessment value for patients with endotracheal tube (ETT).

Health care providers working in ICUs should be familiar with neurological assessments. Therefore, the knowledge of nurses regarding neurological tools should be fully competent [9].

Research questions

1. What is the level of knowledge regarding GCS and FOUR score reported by nurses working in intensive care unit (ICU) in Jordan before intervention?
2. What is the level of perceptions regarding GCS and FOUR score reported by nurses working in intensive care unit (ICU) in Jordan before intervention?
3. What is the impact of the demographic characteristics on the level of knowledge and perceptions of GCS and FOUR score among ICU nurses in Jordan before intervention?
4. What is the impact of training sessions on the level of knowledge and perceptions of ICU nurses toward GCS and FOUR score in Jordan?

Aim of the study

The main purpose of this study was to assess the effectiveness of training sessions among Jordanian ICU nurses' knowledge and perception toward GCS and FOUR score.

METHODS

Research design

A one-group pretest posttest experimental design was used to achieve the aim of the current study.

Setting

This study was conducted in the ICUs of five hospitals in Jordan. Ma'an Governmental hospital is located in the Ma'an Governorate. The average bed capacity was 146. The ICU nurses were 28.

The Queen Rania Governmental Hospital is located in Wadi-Mousa at Ma'an Governorate. The total capacity of the hospital beds was 78. The number of nurses working in the ICU was 15.

Al-Karak Governmental Hospital, with a capacity of 310 beds, is located in the Al-Karak Governorate. ICU nurses were 20.

Ghour Safi Governmental Hospital is located at Al- Karak Governorate in Gawr as-Safi. The capacity of the beds was 98 with 12 ICU nurses.

Al-Tafila Governmental Hospital, the only MOH hospital in the Al-Tafila Governorate, is located in Al-Eyes city. The capacity of the beds was 150. The number of nurses working in the ICU was 25 [2:15].

Sample calculation

A sample size calculation was performed using G*Power version 3.1.9.7 sample size calculator software and by using a mean difference considering prior study parametric for sample size: for the median effect size, the researcher reviewed the related literature [4] and used a Means statistical test on G*Power software to calculate the difference between two dependent means, the median effect size calculated was (0.4), power (0.8), and alpha (0.05). The number of participants was 52, who were calculated to maintain the statistical power of the statistical tests involved.

Inclusion and exclusion criteria

The inclusion criteria were as a following: being a Jordanian full-time registered nurse (RN) bachelor's degree) or associate degree nurse (diploma degree); had experience in the ICU for at least one year; providing direct care to critically ill patients; and finally able to read, write, and understand English languages.

The exclusion criteria were as follows: nurses who leave during the study period; those who are not working in the ICU; and nurses' educator and nurse's managers in ICU. A group of nurses who met the preceding criteria were recruited conveniently from the accessible population.

Sample

The target population considered of ICU nurses in all government hospitals in Jordan. The accessible population included ICU nurses working as critical care nurses (CCN) in the selected hospitals. 71 of ICU nurses who participated in the current study were selected using a convenience sampling technique.

Tools

Data were collected using multiple self-administrated questionnaires. The questionnaire was composed of three parts: the first part included socio-demographic information of nurses, the second part included a pretest-posttest nurses' knowedge questionnaire e [5] to assess the level of knowledge regarding GCS and FOUR score, and finally, the third part included pretest-posttest nurses' perception of both GCS and FOUR score questionnaire [5], all of the questionnaires were in English language.

Socio-demographic form

The first part of the questionnaire included five items reflected nurses' characteristics the nurses' characteristics included; (age, years of experience, gender, marital status, and qualification).

Nurses' knowledge about GCS and four score

The second part of the questionnaire titled "Nurses' knowledge about GCS and FOUR score was developed by Baraka and Shalaby (2021) after they reviewed the related literature [25; 28].

The tool had questions related to ICU nurses' knowledge of GCS and FOUR score consists of seven items; (definition, indications, components, scoring range, limitations of scale, rational of using score, and how to assess the score). For the total score, each test (pretest and posttest) scored (out of seven), whereas the correct answer received one point and the incorrect answer received zero. A total score of 75% or more was indicated good knowledge regarding GCS and FOUR score, a score between 60% and 74% was considered fair. And finally, a score below 60% was considered poor knowledge.

Nurses' perception about GCS and FOUR score

The third part of questionnaire is "nurses' perception of both GCS and FOUR score" that used to evaluate nurses' perception before and after the intervention (pretest-posttest) about GCS and FOUR score. The questionnaire was developed by Baraka and Shalaby (2021) after reviewed the literature [14; 26].

The questionnaire was divided into two parts (GCS and FOUR score), and each part comprised seven items. The items questions are as follows: "it provides detailed clinical information regarding patient's level of consciousness (LOC), it is easy to use, it takes less time to perform, it is preferred tool to assess the depth coma, it is preferred tool to predict the patient outcome, it is accurately reflecting the actual patient's LOC, and it is a coma assessment tool applicable for all patients with no limitation. All items were rated by using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The following categories was used to evaluate the final score of perception level; the total score between 1 to 2.33 considered poor perception, the score between 2.34 to 3.67 considered fair perception, and finally the score between 3.68 to 5 considered good perception.

Validity and Reliability of the tools

Before conducting the study, the researcher conducted a pilot study to test the validity and reliability of the tools that with English version and the methods that were used to ensure an easy, appropriate, and good understanding of the tools. Additionally, a pilot study was conducted to investigate any obstacles in the tools.

Validity analysis

For the face validity, six experts from Al-Hussein bin Talal University department of nursing reviewed the three questionnaires. The experts panel reviewed the appropriateness of the questions, and focusing on accuracy of meaning. Each expert offered valuable notes and suggestions, which were carefully considered as the questionnaires were refined. Moreover, a content validity was done by the same expert panel to ensure that the contents of training session covered the variables that need to be measured accurately. Many of materials were added after the expert panel feed-back.

Reliability analysis

For the reliability of tools, ten of ICUs nurses from Ma'an government hospital and Queen Rania government hospital were enrolled for the purpose of the pilot study. The nurses provided the tools and took 15 minutes to answer the questions, and the data were collected and analyzed; therefore, some of rephrases were made to the knowledge and perception questionnaires according to the feed-back received. The researcher conducted a pilot study to test the reliability of tools that were used to assess the nurses' knowledge and perception regarding GCS and FOUR score; estimate the required time to fill the questionnaires; and clarity and format of questionnaires.

Total of three to four hours of training sessions were appropriate to address GCS and FOUR score knowledge and perception among ICU nurses. Nurses' participant provided a useful feed-back about training session material, clarity, and relevancy. The time that participant required to fill the questionnaires was ranged from 10 to 15 minutes. No difficulties appeared in understanding or in the format of questionnaires. However, as it mentioned before, the researcher has been during the questionnaires filling to answer any questions from the participants.

The collected data among participants in the pilot study were used to test the internal consistency reliability of the instruments (Cronbach's alpha) at one time point: before the intervention (pre-test).

The results showed that adequate internal consistency reliability for nurses' knowledge about GCS and FOUR score questionnaire before the intervention, Cronbach's alpha: 0.82. For the nurses' perceptions of both GCS and FOUR score questionnaire, the results before the intervention, Cronbach's alpha: 0,73. Cronbach's alpha above 0.7 is clinically adequate and acceptable [17 & Beck, 2012). Moreover, the nurses who recruited in this pilot study were excluded from the study.

The intervention

The training sessions were held in the continuous training auditorium in selected hospitals over four hours. The data collection for the study (three phases) was undertaken between September-2023 and October- 2023.The study was conducted in three phases (first phase, second phase, and third phase).

The first phase (preparatory phase), which started with welcoming the nurses' participants by the researcher and introducing himself, then discussing the purpose of study, length of training sessions, and finally inclusion and exclusion criteria of the selection sample. After that, the information sheet of the study was introduced to all participants. The researcher then asked the participants to fill in the first part of the questionnaire to assess their socio- demographic characteristics. Consequently, two pre-test tools were distributed to the participants to assess the current nurses' knowledge regarding GCS and FOUR score and to assess the current nurses' perception regarding GCS and FOUR score with 15 minutes to answer the questionnaires.

In the second phase that termed (the process phase), the training sessions were applied immediately over four hours of duration by utilizing a Power-Point presentation that focuses on the following contents: coma, Glasgow Coma Scale (GCS), and Full Outline of Un- Responsiveness (FOUR) score. In addition, video show of assessment, lectured handouts, interactive discussion between participants, scenarios were applied during the sessions, and neurological assessment of ICU patients was applied in the selected hospitals using GCS and FOUR score tools.

In the final phase, termed (evaluation phase), evaluated nurses' knowledge and perception regarding GCS and FOUR score after the intervention

Data analysis

After collecting the data, coding, entering, and cleaning data of the current sample were performed using the Statistical Package for the Social Science (SPSS) version 28.0.1.1 (15). In addition, data were screened for missing values. All questionnaires (Pre-test and post-test) were checked for completeness at the time of data collection and after data entry.

The correct answers in the nurses' knowledge of GCS and FOUR score questioner took 1 point and coding on SPSS as 1, the wrong answer took zero point and coded respectively, additionally, only (2.8%) of nurses gave a correct answer for FOUR score limitations and rational of using respectively with zero percent of correct answers regarding how to evaluate the final score. The average score of FOUR scores was found to be (0.60±0.96) revealing that all nurses exhibited poor knowledge level regarding the FOUR score.

Table (3) presented the level of perceptions regarding GCS and FOUR score reported by nurses working in intensive care unit (ICU) in Jordan before intervention. Regarding GCS, the nurses displayed a high perception regarding GCS, the highest average score was noted in the item of "it is preferred tool to assess the depth coma "(Mean = 4.25 ± 0.75). The average perception score of critical care nurses in Jordan regarding GCS before intervention was (4.02±0.35). After categorizing to identify their perception levels, the results revealed that the vast majority

had high perception level (85.9%), while a smaller percentage had a fair perception (14.1%) and zero percentage reported poor perception level.

Moving to FOUR score perception, the results indicated that the perception level was below the average for all seven items. However, the item of "it provides detailed clinical information regarding patient's LOC and it is preferred tool to assess the depth coma" achieved the on SPSS as 0. For the nurses' perceptions questionnaire 5-point Likert scale was used and coded on SPSS by used 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree, and 5 for strongly agree.

Sample characteristics were described using descriptive statistics on the level of measurement of demographic variables. The mean and standard deviation (SD) were used to describe variables with continuous levels of measurement including years of experience and age. The variables at the nominal level of measurement, including gender, marital status, and qualification, were used as frequency and percentage as suitable measurement.

RESULT

Table (1) presented critical care nurses' socio demographic characteristics. A total of 71 nurses working in the intensive care units (ICU) of Jordanian governmental hospitals participated in the study. The majority of nurses were females 52 (73.2%), and married 57 (80.3%). The educational qualifications were mainly bachelor's degree in nursing 56 (78.90%), with a smaller proportion holding diploma 7 (9.90 %), and higher degrees 8 (11.30%). The nurses' mean age and work experience were found to be (32.41±4.95 years) and (9.21±5.54 years) respectively.

Table (2) presented the level of knowledge regarding GCS and FOUR score reported by nurses working in intensive care unit (ICU) in Jordan before intervention. For the GCS, the results have demonstrated that (87.3%, 69.0%, 56.3%, 53.5%, 43.7%, 38.0%, 22.5%) of nurses

have correctly answers question about GCS definition, indications, minimum and maximum score, components, limitations, rational, and evaluate the final score respectively. The final mean score for GCS was found (3.70±2.2) out of 7 and when it categorized, the results have shown that (59.2%) of nurses had poor knowledge regarding GCS, (15.5%) and (25.4%) demonstrated fair- good knowledge level.

Concerning FOUR score, the nurses showed an inadequate level of knowledge regarding the FOUR score with (16.9% and 19.7%) of them provided accurate answers regarding the definition and the indications of FOUR score. Moreover, (9.9% and 7.0%) have correctly identified the FOUR score components and its range score highest average score (2.38±0.88 and 2.38±0.98) respectively. The average perception score of critical nurses in Jordan before intervention regarding FOUR score was (2.23±0.39), after categorizing to identify their perception levels, the results revealed that the majority had poor perception level (63.4%), while more than one-third had a fair perception (36.6%) and zero percentage showed high perception level.

Table (4) presented the impact of the demographic characteristics on the level of knowledge and perceptions of GCS and FOUR score among ICU nurses in Jordan before intervention, the nurses' gender, marital status, age and work experience were insignificantly correlated with GCS and FOUR score baseline knowledge scores ($p < 0.05$) for all. However, the nurses' education qualifications were significantly positively correlated with GCS baseline knowledge score ($r_s = 0.269$, $p=0.023$) while insignificant with the FOUR baseline knowledge score ($p=0.894$). Furthermore, neither gender, marital status, education level, age, nor work experience demonstrated a significant relationship with GCS and FOUR perceptions.

Table (5) presented the impact of training sessions on the level of knowledge among ICU nurses toward GCS in Jordan. The differences in the average scores between the pretest and posttest showed that there was a statistically significant difference, indicating that the post-test score (Mean=6.21) was notably higher than the pretest score (Mean = 3.70; $p <0.001$). Additionally, the Cohen's d for effect size was found to be (d=1.19 with 95% CI 0.88-1.49) indicating that the posttest score was 1.19 standard deviation higher than pretest score, which reveals that the training sessions have achieved a large effect size on their GCS knowledge level.

Table (6) presented the impact of training sessions on the level of knowledge among ICU nurses toward FOUR score in Jordan. The nurses demonstrated a notably stronger performance in their knowledge of FOUR score compared to the GCS. The percentage of change for the correct answers was drastically increased from pretest score (Mean=0.60) to posttest score (Mean= 5.84). Additionally, the mean difference between pretest and posttest was statistically significant in favor of posttest score ($p<0.001$) with large effect size (d=3.63 with 95% CI 2.98-4.27).

Table (7) presented the impact of training sessions on the level of perceptions among ICU nurses toward GCS in Jordan. The nurses' perception score on the posttest was not statistically significantly different than the pretest score in terms of the GCS can provide detailed clinical information regarding patients' LOC; it is easy to use; it takes less time to apply; and it is accurately reflecting the actual patient's LOC ($p<0.05$) for all.

On the other hand, the nurses demonstrated lower perception mean score after applying the training sessions compared to before applying the training sessions regarding GCS is preferred tool to assess the depth coma; it is preferred tool to predict the patient outcome; and it is applicable for all patients with no limitation ($p<0.05$) for all. Additionally, the posttest perception score was significantly lower than the pretest score (Mean=3.81±0.74 vs. Mean=4.02±0.35) ($p=0.034$) with small effect size (d=0.257 with 95% CI 0.020- 0.493).

Table (8) presented the impact of training sessions on the level of perceptions among ICU nurses toward FOUR score in Jordan. The nurses' perception towards FOUR score increased on the post-test, with a statistically significant mean difference ($p<0.001$) for all items. The item related to that FOUR score is a tool use to predict the patient's outcome and use to assess the depth of coma have achieved the highest mean difference, while the lowest mean difference in their perception between the two points of measurement was observed in the item related to FOUR score, which is easy to use and takes less time to apply. Generally, the average scale score was significantly higher on the post-test compared to the pre-test (4.46±0.58 vs.2.23±0.39) ($p<0.001$) with large effect size (d=3.17 with 95%CI 2.59-3.73).

Table (1): Critical care nurses' socio-demographic characteristics N=71.

Variables	Subcategories	Frequency	Percentage	Mean±SD
Gender	Male	19	26.80	
	Female	52	73.20	
Marital status	Unmarried	14	19.70	

Variables	Subcategories	Frequency	Percentage	Mean±SD
	Married	57	80.30	
Education	Diploma degree	7	9.90	
qualifications	Bachelor degree	56	78.90	
	Higher degrees	8	11.30	
Age				32.41±4.95
Work experience				9.21±5.54

SD= Standard Deviation

Table (2): The level of knowledge regarding GCS and FOUR score reported by critical care nurses before intervention.

Knowledge Items	Pretest-GCS score N=71		Knowledge Items	Pretest-FOUR score N=71	
	Wrong n(%)	Correct n(%)		Wrong n(%)	Correct n(%)
1-Define GCS	9(12.7%)	62(87.3%)	1- Define FOUR score	59(83.1%)	12(16.9%)
2- Indication for using GCS	22(31.0%)	49(69.0%)	2- Indication for using FOUR score	57(80.3%)	14(19.7%)
3- Components of GCS	33(46.5%)	38(53.5%)	3- Components of FOUR score	64(90.1%)	7(9.9%)
4- Minimum and maximum score of GCS	31(43.7%)	40(56.3%)	4- Minimum and maximum score of FOUR scores	66(93.0%)	5(7.0%)
5- Limitations for using GCS	40(56.3%)	31(43.7%)	5- Limitations for using FOUR score	69(97.2%)	2(2.8%)
6- Rational for using GCS	44(62.0%)	27(38.0%)	6 -Rational for using FOUR score	69(97.2%)	2(2.8%)
7- Evaluate the final score of GCS	55(77.5%)	16(22.5%)	7- Evaluate the final score of FOUR scores	71(100.0%)	0(0.0%)
GCS. Knowledge level Mean ± SD 3.70 ± 2.2	**Poor Fair Good**	42 (59.2%) 11(15.5%) 18(25.4%)	**FOUR score knowledge level Mean±SD 0.60±0.96**	71(100.0%) 0(0.0%) 0(0.0%)	

SD= Standard Deviation

Table (3): The level of perceptions regarding GCS and FOUR score reported by critical care nurses before intervention.

Items		Perception regarding GCS N=71	Perception regarding FOUR score N=71
		Pretest Mean±SD	Pretest Mean±SD
1-It provides detailed clinical information regarding patient's LOC.		3.86±0.90	2.38±0.88
2- It is easy to use.		4.10±0.78	2.24±0.92
3- It takes less time to perform.		3.94±0.89	2.21±0.88
4- It is preferred tool to assess the depth coma		4.25±0.75	2.38±0.98
5- It is preferred tool to predict the patient outcome.		4.17±0.89	2.06±0.84
6- It is accurately reflecting the actual patients; LOC.		3.92±0.91	2.25±0.81
7-It is a coma assessment tool applicable for all patients with no limitation.		3.90±1.06	2.10±0.78
Total scale mean score ±SD		4.02±0.35	2.23±0.39
Perception levels n(%)	**Poor 1-2.33**	0(0.0%)	45(63.4%)
	Fair 2.34-3.67	10(14.1%)	26(36.6%)
	Good 3.68-5.0	61(85.9%)	0(0.0%)

SD= Standard Deviation

Table (4) The impact of the demographic characteristics on the level of knowledge of GCS and FOUR score among ICU nurses in Jordan before intervention.

Variable	Sub- category	Type of correlation	Pretest-GCS knowledge score	Pretest-FOUR knowledge score	Pretest-GCS perception score	Pretest- FOUR perception score
Gender	Male Female	Point-biserial (r_{pb})	r_{pb}=-0.097 p= 0.442	r_{pb}=-0.092 p= 0.447	r_{pb}=-0.121 p= 0.316	r_{pb}= 0.11 p= 0.346
Marital status	Un-married Married	Point-biserial (r_{pb})	r_{pb}=-0.019 p= 0.878	r_{pb}= 0.010 p= 0.931	r_{pb}=0.115 p= 0.340	r_{pb}= 0.08 p= 0.498
Education qualifications	Diploma degree Bachelor degree Higher degrees	Spearman rho (r_s)	r_s= 0.269 **p= 0.023***	r_s= -0.016 p= 0.894	r_s= 0.088 p= 0.464	r_s= 0.145 p= 0.228
Age		Pearson (r)	r= 0.061 p= 0.612	r= -0.219 p= 0.067	r= 0.119 p= 0.324	r= 0.017 p= 0.890
Work experience		Pearson (r)	r= 0.085 p= 0.480	r= -0.224 p= 0.060	r= -0.009 p= 0.937	r= 0.001 p= 0.966

* p<0.05, rpb= point biserial correlation, rs= spearman correlation, r = Pearson correlation.

Table (5) The impact of training sessions on the level of knowledge among ICU nurses towards GCS.

Items	Knowledge regarding GCS			McNemar $\chi 2$	p-value
	Pretest n(%)	Posttest n(%)	% of change		
1- Define GCS	62(87.3%)	71(100.0%)	14.5	7.11	0.004**
2- Indication for using GCS	49(69.0%)	66(93.0%)	34.8	13.47	<0.001**
3- Components of GCS	38(53.5%)	68(95.8%)	79.1	26.28	<0.001**
4- Minimum and maximum score of GCS	40(56.3%)	67(94.4%)	67.7	25.04	<0.001**
5- Limitations for using GCS	31(43.7%)	64(90.1%)	106.2	29.25	<0.001**
6- Rational for using GCS	27(38.0%)	60(84.5%)	122.4	27.67	<0.001**
7- Evaluate the final score of GCS	16(22.5%)	45(63.4%)	181.8	27.03	<0.001**
Total scale mean score ±SD	3.70±2.20	6.21±0.97		t=10.01	<0.001**
Effect size Cohen's d for paired t-test	Cohen's d	95.% Confidence Interval			
		Lower		Upper	
	1.19	0.88		1.49	

% of change= (%posttest -%pretest) %pretest*100, Cohen's d= 0.2 small, 0.5 medium, 0.8 large effect size, ** p<0.01, SD= Standard Deviation.

Table (6) The impact of training sessions on the level of knowledge among ICU nurses toward FOUR score.

Items	Knowledge regarding FOUR score			McNemar $\chi 2$	p-value
	Pretest n(%)	Posttest n(%)	% of change		
1- Define FOUR score	12(16.9%)	66(93.0%)	450.3	50.16	<0.001**
2- Indication for using FOUR score	14(19.7%)	60(84.5%)	328.9	42.19	<0.001**
3- Components of FOUR score	7(9.9%)	64(90.1%)	810.1	55.012	<0.001**
4- Minimum and maximum score of FOUR scores	5(7.0%)	68(95.8%)	1268.6	61.02	<0.001**
5- Limitations for using FOUR score	2(2.8%)	60(84.5%)	2917.9	56.01	<0.001**
6 -Rational for using FOUR score	2(2.8%)	52(73.2%)	2514.3	48.02	<0.001**
7- Evaluate the final score of FOUR scores	0(0.0%)	45(63.4%)	--	43.02	<0.001**
Total scale mean score ±SD	0.60±96	5.84±1.17		t= 30.711	<0.001**
Effect size Cohen's d for paired t-test	Cohen's d	95.% Confidence Interval			
		Lower		Upper	
	3.63	2.98		4.27	

% of change= (%posttest -%pretest) %pretest*100, Cohen's d= 0.2 small, 0.5 medium, 0.8 large effect size, ** p<0.01, SD= Standard Deviation

Table (7): The impact of training sessions on the level of perceptions among ICU nurses toward GCS score.

Items	Perception regarding GCS		t-value	p-value
	Pretest Mean±SD	Posttest Mean±SD		
1-It provides detailed clinical information regarding patient's LOC	3.86±0.90	3.93±0.95	0.472	0.638
2- It is easy to use.	4.10±0.78	4.18±0.95	0.580	0.564
3- It takes less time to perform.	3.94±0.89	4.18±0.85	1.83	0.071
4- It is preferred tool to assess the depth coma.	4.25±0.75	3.56±1.10	4.49	0.001**
5-It is preferred tool to predict the patient outcome.	4.17±0.89	3.72±1.00	2.79	0.007**
6- It is accurately reflecting the actual patient's LOC	3.92±0.91	3.72±1.00	1.28	0.203
7- It is a coma assessment tool applicable for all patients with no limitation.	3.90±1.06	3.39±1.19	2.73	0.008**
Total scale mean score ±SD	4.02±0.35	3.81±0.74	2.166	0.034*
Effect size Cohen's d	Cohen's d	95.% confidence interval		
		Lower		Upper

SD= Standard Deviation. Cohen's d= 0.2 small, 0.5 medium, 0.8 large effect size, ** p<0.01

Table (8): The impact of training sessions on the level of perceptions among ICU nurses toward FOUR score.

Items	Perception regarding FOUR score		t-value	p-value
	Pretest Mean±SD	Posttest Mean±SD		
1-It provides detailed clinical information regarding patient's LOC	2.38±0.88	4.52±0.84	15.52	<0.001**
2- It is easy to use.	2.24±0.92	4.39±0.85	13.57	<0.001**
3- It takes less time to perform.	2.21±0.88	4.23±0.91	13.24	<0.001**
4- It is preferred tool to assess the depth coma.	2.06±0.84	4.59±0.75	19.78	<0.001**
5- It is preferred tool to predict the patient outcome.	2.06±0.84	4.48±0.69	20.22	<0.001**
6- It is accurately reflecting the actual patient's LOC	2.25±0.81	4.59±0.67	18.92	<0.001**
7- It is a coma assessment tool applicable for all patients with no limitation.	2.10±0.78	4.42±0.93	15.24	<0.001**
Total scale mean score ±SD	2.23±0.39	4.46±0.58	26.74	<0.001**
Effect size Cohen's d	Cohen's d	95.% confidence interval		
		Lower		Upper
	3.17	2.59		3.73

DISCUSSION

Health care providers working in ICUs should be familiar with neurological assessments. Therefore, the knowledge of nurses regarding GCS and FOUR score should be fully competent [9]. Furthermore, perception regarding GCS and FOUR score is important to familiarize nurses with the coma scale tools. Nurses' perceptions regarding GCS were generally good [29].

Regarding Jordanian ICU nurses' knowedge of GCS and FOUR score before intervention, the current study showed that the nurses displayed more knowledge about GCS than the FOUR score before the training sessions. According to the results of the current study, the final mean score of the ICU nurses' knowledge regarding GCS represents nearly the same final mean score of a study conducted in 2021 [5]. The results also represent that more than half (59.2%) of ICU nurses demonstrated poor knowledge regarding GCS, this finding make a concern about the Jordanian ICU knowledge regarding the GCS, especially that

GCS is a routinely used tool in the critical care settings to assess the critically ill patients' neurological status and IOC. This finding is supported by a Jordanian study concluded that the Jordanian nurses had an inadequate knowledge regarding GCS [3]. In addition, many studies have revealed that nurses had a low level of knowledge of GCS [1]. In contrast, another study revealed that ICU nurses had a good knowledge regarding GCS [22].

Moving to FOUR score, all of the Jordanian nurses demonstrated poor knowledge about FOUR score. The FOUR score average score was nearly the same as that reported by Baraka and Shalaby (2021). The nurses demonstrated poor knowledge about FOUR score for all items which is similar to the findings of researchers [5]. In contrast, Bamani (2021) concluded that the vast majority of ICU nurses had average knowledge of FOUR score. The poor of knowledge regarding FOUR score may be because the ICU nurses were unfamiliar with the new coma scale tools, and the Jordanian governmental hospitals still used the usual coma assessment tools as GCS.

Regarding Jordanian ICU nurses' perception level of GCS and FOUR score before intervention, the current study showed that the nurses had a higher perception of GCS than the FOUR score before the training sessions, these results were not consistent with many studies demonstrated that nurses have good perception of FOUR score more than GCS [29]. The low perception average regarding FOUR score may be explained by the tendency of universities in Jordan to focus on GCS in nursing curriculum teaching. In addition, the ICU setting in Jordan applies only the GCS as a neurological assessment tool in the ICUs' policy.

For the impact of gender, marital status, educational qualification, age, and work experience on the knowledge and perception of Jordanian ICU nurses regarding GCS and FOUR score. The current study showed that there is a significant relationship between nurses' knowledge regarding GCS only with educational qualification. This result is supported by Baraka and Shalaby (2021), this result may reflected that nurses who had a Bachelor degree in nursing (four years) studied critical care and neurocritical care in their curriculums at the university, they

focused more about GCS. On the other hand, Jordanian ICU nurses who had a diploma degree in nursing (two years) did not learn about coma scales, and their curricula focused more on technical practice. Furthermore, regarding FOUR score the results showed no relationship between the demographic variables and knowledge and perception of Jordanian ICU nurses, which might be due to the unfamiliarity of nurses regarding FOUR score even if the nurses had a high qualification education.

For the impact of training session regarding GCS and FOUR score on Jordanian ICU nurses' knowledge, the total GCS mean score of the knowledge pre-test was notably improved in the post-test, the positive improvement of knowledge about GCS after the training sessions is consistent with the results of previous interventions in the literatures [13]. For the GCS knowledge items, which were; definition of GCS, indication for using GCS, components of GCS, minimum and maximum score of GCS, GCS limitation, rational of using GCS, and evaluation the final GCS score, there was a significant improvement of knowledge regarding these items among ICU nurses. the current result is not consistent with an Egyptian study that found that the improvement in knowledge regarding GCS was not significant for all items (4 & Shalaby, 2021), which may reflect the quality and the content of current study training sessions regarding GCS knowledge among Jordanian ICU nurses.

Moving to the FOUR score, the total FOUR score mean score of the knowledge pre-test was very low, then there was a drastically improvement after the training sessions and this improvement was significant. The high improvement in the mean knowledge score between pre- test and post-test indicates the effectiveness of training sessions in terms of FOUR score knowledge among ICU Jordanian nurses. The effectiveness of knowledge regarding FOUR score is consistent with the finding of many studies [23; 4; 5 & Shalaby, 2021). For the items of the FOUR score knowledge which are "definition; indications; components; minimum and maximum score; limitation; rational of using FOUR score; and evaluation the final score". In line with other studies, the current result is totally consistent with a study by Baraka and Shalaby (2021), who found that an improvement in knowledge regarding FOUR score for all items.

Finally, training sessions regarding GCS and FOUR score were effective in improving the Jordanian ICU nurses' knowledge. Howeve, there was a stronger improvement in nurses' knowledge regarding FOUR score than GCS, which may reflect the easiest introduction of the FOUR score by the researcher as a new coma scale tool in Jordanian governmental hospitals. The improvement in GCS knowledge was significant, but the nurses known the GCS before the intervention. However, they moving their focus on FOUR score as a new coma tool.

For the impact of training session regarding GCS and FOUR score on Jordanian ICU nurses' perception, nurses perception improved regarding FOUR score. On the other hand, nurses' perception of GCS did not improve on many items.

For GCS, the total GCS mean score of the perception pre-test was decreased in the post-test, the decreased mean score of perception before and after the intervention might be due to the contents of the training sessions that are rich with up-to-date articles with systematic reviews that reflect the superiority of FOUR score upon GCS when dealing with critically ill patients especially who are in a coma, this moved the interest of ICU nurses from GCS toward FOUR score. However, this result was not consistent with Baraka and Shalaby (2021), There was an improvement in Jordanian ICU nurses' perception regarding GCS after the intervention that appeared on the following items: it provides detailed clinical information regarding patients' OC, it is easy to use, and it takes less time to perform. These results were consistent with a Filipiniana study [29].

Regarding FOUR score, the results of the current study showed an increase in Jordanian ICU nurses' perception of FOUR score mean score. The total FOUR score mean score of perception pre-test was increased in the post-test. These results are consistent with those of Yglesias and Suson II (2020), who demonstrated that nurses showed the FOUR score as an accurate and more comprehensive tool than other coma scales. The high and significant improvement of perception among Jordanian ICU nurses toward FOUR score may be due to the ability of Jordanian nurses to make changes regarding the coma scales that were used. Moreover, the significant improvement of nurses' perception regarding the FOUR score among all the perceptions; tool item makes the FOUR score the best coma scale for Jordanian nurses. Here the Jordanian ICU nurses tend to make change and willing toward new coma scales.

Limitation and strength of the study

The study was conducted in the entire south of Jordan government hospitals only, which might be considered when generalizing the study findings. The type of sampling used in this study was convenience sampling and this type had a limitation especially regarding bias, compared to the random sampling technique. Moreover, there was one group intervention study rather than two groups (control and intervention) which might have affected the findings. However, this design is commonly used in scientific research.

The strength of this study include the following: the current study is considered to be the first of its kind in Jordan and Middle east that assessed the effectiveness of training sessions among Jordanian ICU nurses; knowledge and perception toward GCS and FOUR score, and none of the studies in Jordan that applied the FOUR score as a coma tool.

RECOMMENDATION

Although 71 ICU were recruited in the current study, future research may need to increase the number of samples recruited from other wards (surgical, medical, and emergency departments).

The researcher conducted a one group pre- experimental study. However, a true experimental design with two groups (control and intervention) is recommended. Furthermore, a longitudinal study recommended to assess the nurses' knowledge and perception after short and long time of intervention.

CONCLUSION

This study emphasizes the importance of applying training sessions inside ICU settings to improve nurses' knowledge and perception regarding GCS and FOUR score, as this helps improve critically ill patients' outcomes and the quality of nursing care.

Abbreviation

GCS: Glasgow coma scale

FOUR score: Full Outline of Un-Responsiveness score ICU: Intensive care unit

ICU: Intensive care unit

TBI: Traumatic brain injury LOC: Level of consciousness VA: Motor vehicle accidents

LOC: Level of consciousness

VA: Motor vehicle accidents

CCUs: Critical care units CCN: Critical care nurses RN: Registered nurse

CCN: Critical care nurses

RN: Registered nurse

Disclosure Statement

- **Ethics approval and consent to participate:** The Institutional Review Board at Ministry of health in Jordan approved this study on 10/9/2023 (Ref no. 2023-335). All participants provided informed consent. The permission to use the measurement instruments has been received from the original author.
- **Consent for publication:** The authors given the publisher the authors' permission to publish the work.
- **Availability of data and materials:** The data sets supporting the current research results are stored on a personal hard drive and available from the corresponding author upon request.
- **Author's contribution: Ahmad Alnawafleh:** Study conception, data collection, writing review, and editing, **Hiyam Alaraj:** data analysis, validation, methodology, and draft manuscript preparation. All authors reviewed the results and approved the final version of the manuscript**.**
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REFERENCES

1] Alhassan A, Fuseini AG, Musah A. Knowledge of the Glasgow Coma Scale among nurses in a tertiary hospital in Ghana. Nurs Res Pract. 2019;2019:1-7. doi:10.1155/2019/5829028
2] Al-Maaitah R, Shokeh D. The nursing workforce in Jordan: a policy oriented approach. Jordanian Nursing Council; 2009.
3] Al-Quraan H, AbuRuz ME. Assessment of Jordanian nurses' knowledge to perform Glasgow Coma Scale. Eur Sci J. 2016;12(27). doi:10.19044/esj.2016.v12n27p208
4] Bamani M. Study to assess the effectiveness of structured teaching programme on knowledge regarding FOUR score coma scale among staff nurses working in intensive care units. Int J Nurs Educ Res. 2021;9(1):74-6. doi:10.5958/2454-2660.2021.00018.1
5] Baraka A, Shalaby SA. Effect of training sessions about Full Outline of UnResponsiveness scale compared to Glasgow Coma Scale on nurses' performance perception and its reliability. Egypt J Health Care. 2021;12(1):54-72. doi:10.21608/ejhc.2021.135122
6] Centers for Disease Control and Prevention (CDC). Traumatic brain injury / concussion. 2023 Feb 20. Available from: https://www.cdc.gov/traumaticbraininjury/index.html
7] De Jonghe B, Cook DJ, Appéré-De-Vecchi C, Guyatt G, Meade MO, Outin H. Using and understanding sedation scoring systems: a systematic review. Intensive Care Med. 2000;26(3):275-85. doi:10.1007/s001340051150
8] Dewan MC, Rattani A, Gupta S, Baticulon RE, Hung Y, Punchak M, et al. Estimating the global incidence of traumatic brain injury. J Neurosurg. 2019;130(4):1080-97. doi:10.3171/2017.10.JNS17352
9] Ehwarieme TA, Anarado AN. Nurses' knowledge of Glasgow Coma Scale in neurological assessment in a tertiary hospital in Edo State, Nigeria. Afr J Nurs Midwifery. 2016;18(2):74-86. doi:10.25159/2520-5293/1068
10] El-Menyar A, Mekkodathil A, Al-Thani H, Consunji R, Latifi R. Incidence, demographics, and outcome of traumatic brain injury in the Middle East: a systematic review. World Neurosurg. 2017;107:6-21. doi:10.1016/j.wneu.2017.07.070
11] Jennett B, Teasdale G. Aspects of coma after severe head injury. Lancet. 1977;309(8017):878-81. doi:10.1016/S0140-6736(77)91201-6
12] Johnson VD, Whitcomb J. Neuro/trauma ICU nurses' perception of the use of the FOUR score versus the Glasgow Coma Scale. Dimens Crit Care Nurs. 2013;32(4):180-3. doi:10.1097/DCC.0b013e3182998082
13] Joshi C, Yadav S. Effectiveness of structured educational programme in term of knowledge regarding Glasgow Coma Scale among staff nurses. Int J Multidiscip Educ Res. 2021;10(11(5)). Available from: http://ijmer.in.doi./2021/10.11.93
14] Mercy A, Thakur SR, Yaddanapudi S, Bhagat H. Can FOUR score replace GCS for assessing neurological status of critically ill patients? Nurs Midwifery Res J. 2013;9(2):63-72. doi:10.1177/0974150X20130203
15] Ministry of Health. Ministry of health hospitals. 2023. Available from: https://moh.gov.jo/EN/List/Ministry_of_Health_Hospitals_
16] Okasha AS, Fayed AM, Saleh AS. The FOUR score predicts mortality, intubation and ICU stay after TBI. Neurocrit Care. 2014;21:496-504. doi:10.1007/s12028-014-9995-6
17] Polit DF, Beck CT. Nursing research: generating and assessing evidence for nursing practice. 9th ed. Philadelphia: Wolters Kluwer; 2012. ISBN: 9781605477084
18] Poser CM. The diagnosis of stupor and coma. JAMA. 1981;245(7):772. doi:10.1001/jama.1981.03310320080042
19] Public Security Directorate. Digital statistics. 2021. Available from: https://www.psd.gov.jo/en-us/content/digital-statistics
20] Reith FC, Lingsma HF, Gabbe B, Lecky F, Roberts I, Maas AI. Differential effects of the Glasgow Coma Scale Score and its components: analysis of 54,069 TBI patients. Injury. 2017;48(9):1932-43. doi:10.1016/j.injury.2017.05.038
21] Roy A, Mukhopadhyay M, Sarkar M, Koner T. Epidemiology of head injuries in a rural tertiary care hospital in West Bengal. IOSR J Dent Med Sci. 2019;18(11):39-42. doi:10.9790/0853-1811113942
22] Santos WC, Campanharo CRV, Lopes MCBT, Okuno MFP, Batista REA. Assessment of nurses' knowledge about GCS at a university hospital. Einstein (São Paulo). 2016;14(2):213-8. doi:10.1590/S1679-45082016AO3618
23] Sharma A, Kumari B, Thakur D, Jaswal D, Garg H, Kumari H, et al. The effectiveness of structured teaching programme on FOUR score among staff nurses. Int J Neurol Nurs. 2018;4(2):1-7. doi:10.37628/ijnn.v4i2.836
24] Singh B, Chong MC, Zakaria MIB, Cheng ST, Tang LY, Azahar NH. Assessing nurses' knowledge of Glasgow Coma Scale in emergency and outpatient departments. Nurs Res Pract. 2016;2016:1-6. doi:10.1155/2016/8056350
25] Smeltzer S, Bare B, Hinkle J, Cheever K. Brunner and Suddarth's textbook of medical-surgical nursing. 12th ed. Philadelphia: Lippincott Williams & Wilkins; 2010.
26] Teasdale G, Jennett B. Assessment of coma and impaired consciousness: a practical scale. Lancet. 1974;304(7872):81-4. doi:10.1016/S0140-6736(74)91639-0
27] Teasdale GM, Maas AI, Lecky F, Manley GT, Stocchetti N, Murray GD. The Glasgow Coma Scale at 40 years: standing the test of time. Lancet Neurol. 2014;13(8):844-54. doi:10.1016/S1474-4422(14)70120-6
28] Wijdicks EFM, Bamlet WR, Maramattom BV, Manno EM, McClelland RL. Validation of a new coma scale: the FOUR score. Ann Neurol. 2005;58(4):585-93. doi:10.1002/ana.20611
29] Yglesias MRA, Suson II. Awareness and perception of FOUR score scale versus GCS among intubated patients. Malays J Nurs. 2020;12(1):63-72. doi:10.31674/mjn.2020.v12i01.008