

## Comparison between neurological assessment of inexperienced and experienced intensive care nurses using GCS and FOUR.

Intessar Mohamed Ahmed

Critical Care & Emergency Nursing, Faculty of Nursing, Damanhur University, Egypt.  
[drmohamed.intessarmohamed@yahoo.com](mailto:drmohamed.intessarmohamed@yahoo.com)

**Abstract:** Neurological assessment of those comatose patients and their outcome prediction are complex due to the difficulty of capture indistinct details of the clinical examination. The complexity of such assessment can also be explained by the difficulty of finding usable terminology permitting to describe the neurological status of a single patient. In recognition of these problems, scales have been constructed in an attempt to bring uniformity to the neurological examination and to standardize communication about the level of consciousness. The most commonly used scale is the Glasgow Coma Scale (GCS) and FOUR. **Aim:** The aim of this study was to compare between neurological assessment of inexperienced and experienced intensive care nurses using GCS and FOUR. **Materials and Methods:** This study involved 100 nurses, it has a quasi experimental design and it was carried out at Unit I, Unit III and emergency room at the main university hospital, Alexandria University. In addition, a convenience sample of 50 patients with disturbed level of consciousness was chosen to be examined in this study. A highly qualified nurse with at least 2 years of experience in ICU and at least 1 year of current neuroscience nursing was used as comparison subject. A neurological assessment sheet was developed by the researcher and used to collect data by every inexperienced nurse. It included Patients characteristics, Glasgow coma scale and FOUR scales. In addition an observational checklist was developed by researcher to be used by experienced nurse. Before data collection all inexperienced nurse received instruction in the use of the GCS and FOU. Then, every patient was examined by 2 inexperienced nurses and the experienced nurse at the same time. GCS and FOU were measured every 6 hours for 3 times /day and repeated for 2 days by the same nurses. The experienced nurse observed all procedures and made written notes on any departures from protocol as they occurred in checklist. Then when 2 nurses had dispersed, she made her own GCS and FOU observations. **Results:** It was found that scores of GCS and FOUR which was obtained by inexperienced nurse was less than mean score of GCS and FOUR which was obtained by experienced nurse during 2 days with significant difference at second day and total scores of the two days. Mean of GCS rating scores increased with mean of FOUR rating scores with both of inexperienced and experienced nurse. GCS and FOUR rating scores of inexperienced nurse was significantly correlated with GCS and FOUR rating score of experienced nurse. The median of GCS rating scores differences between experienced nurse recording scores and those were recorded by inexperienced nurse was more than 3 points with spinal cord injured patients, patients with hepatic encephalopathy and poisoned patients. Moreover, the median of FOUR rating scores differences between experienced nurse recording scores and those were recorded by inexperienced nurse was more than 4 points with spinal cord injured patients and patients with hepatic encephalopathy. **Conclusion:** The finding of the present study showed that inexperienced nurses made neurological assessment using GCS and FOUR accurately. The GCS is an important tool in the assessment of patients. But, there is no doubt that the FOUR provides an adequate initial assessment of patients with disturbed level of consciousness and it can be easily used by inexperienced nurse. Errors occurred in the assessment of spinal cord injured patients and an understanding of how these can occur will be important if the quality of nursing care is to be improved.

[Intessar Mohamed Ahmed. **Comparison between neurological assessment of inexperienced and experienced intensive care nurses using GCS and FOUR.** *J Am Sci* 2015;11(1s):1-7]. (ISSN: 1545-1003). <http://www.jofamericanscience.org>. 1

**Key words:** Comparison, neurological assessment, inexperienced, experienced, nurses, GCS, FOUR.

### 1. Introduction:

Some patients may be awoken but remain unresponsive following severe brain damage and coma. This clinical syndrome is called vegetative/unresponsive state<sup>(1, 2)</sup>. Patients, who do recover, classically evolve to a minimally conscious state, defined by the presence of non-reflex voluntary movements such as orientation to pain, eye tracking, or inconsistent command was following. By

definition, minimally conscious state patients cannot communicate their thoughts or wishes<sup>(3)</sup>.

The clinical assessment of consciousness relies on disentangling automatic responses from non-reflex oriented movements or command following. These can be very challenging in coma and related disorders. Misdiagnosis can have clinical and therapeutic consequences, especially with regard to treatment of pain<sup>(4, 5)</sup>. Contrary to patients in

vegetative/unresponsive state, those in minimally conscious state retain some capacity for cognitive, emotional, and pain processing<sup>(6-8)</sup>.

Neurological assessment of those comatose patients and their outcome prediction are complex due to the difficulty of capture indistinct details of the clinical examination. The complexity of such assessment can also be explained by the difficulty of finding usable terminology permitting to describe the neurological status of a single patient. In recognition of these problems, scales have been constructed in an attempt to bring uniformity to the neurological examination and to standardize communication about the level of consciousness.

The most commonly used scale is the Glasgow Coma Scale (GCS)<sup>(9)</sup>. The GCS initially intended to assess the level of consciousness after head injury in neurosurgical intensive care unit is widely used in neurological patients beyond the original intentions in the context of outcome prediction<sup>(10)</sup>, neurosurgical prognostic indicator<sup>(11)</sup>, cerebral dysfunction measurement<sup>(12)</sup>, and consciousness evaluation<sup>(13)</sup>.

Since its introduction in 1974 the Glasgow Coma Scale GCS has gained widespread acceptance around the world as a means of assessing the level of consciousness of patients with head injury. Its primary purpose is to alert medical and nursing staff to deterioration in a patient's neurological status<sup>(14)</sup>. Subsequent research on the GCS has with few exceptions taken the reliability of the scale as assured. The establishment of a high level of observer agreement is a necessary but not sufficient condition for continued faith in the GCS<sup>(15)</sup>.

Wijdicks<sup>(16)</sup> presented a new coma scale named the Full Outline of UnResponsiveness (FOUR) as an alternative to the GCS/GLS in the evaluation of consciousness in severely brain-damaged patients. The FOUR score, contrary to the GCS, avoids assessing verbal function. By contrast to the GCS, the FOUR score does not rely on a verbal response. In the ICU, a variety of conditions such as intubation, sedation, or delirium preclude a reliable assessment of a verbal response which makes accurate assessment of verbal responses difficult and, therefore, the FOUR score is an attractive tool.

The FOUR is a valid tool with prognostic value comparable to GCS. The FOUR score may offer the additional advantage to be performable in intubated patients and to identify nonverbal signs of consciousness by assessing visual pursuit<sup>(16)</sup>.

This study addresses questions that include; first, it looks at the accuracy of ratings, by comparing the ratings made by inexperienced nurses and those made by an experienced nurse, and determining where and under what circumstances important errors occur.

Finally, this study aimed to examine accuracy of the different coma scales.

### **Aim of the study:**

The aim of this study was to compare between neurological assessment of inexperienced and experienced intensive care nurses by using GCS and FOUR.

## **2. Materials and Methods:**

### **A-Design:**

This study has quazi experimental design.

### **B-Setting:**

The study was carried out at Unit I, Unit III and emergency room at the main university hospital, Alexandria University.

### **C- Study population:**

This study involved 100 newly graduated or internship inexperienced intensive care nurses employed in previously mentioned units as subjects. In addition, a convenience sample of 50 patients with disturbed level of consciousness was chosen to be examined in this study. A highly qualified nurse with at least 2 years of experience in ICU and at least 1 year of current neuroscience nursing was used as comparison subject.

### **Tool of data collection:**

1- A neurological assessment sheet was developed by the researcher and used to collect data by every inexperienced nurse. It consisted of 3 parts:

#### **Part I: Patients characteristics:**

It included patient's name, age, sex, diagnosis.

#### **Part II: Glasgow coma scale:**

It consisted of ratings for eye opening based a four – point scale and those of verbal response and motor response on five – point scales.

#### **Part III: FOUR scale:**

It consisted of ratings for eye opening, verbal response, brainstem reflexes and respiration based on a four – point scale.

An observational checklist was developed by researcher to be used by experienced nurse.

### **Methods:**

Permission to conduct the study was obtained from the director of each unit.

After reviewing related literature to fulfill the aim of the study, tools were developed by the researcher. The tools were tested by 5 experts in critical care nursing for content validity (90%). Tool

reliability was asserted by using the cronbach,s coefficient alpha test. The reliability coefficient was 0.77.

A pilot study was carried out on five nurses to check and ensure the clarity and applicability of the tool and the necessary modifications were done.

All nurses involved in the study were told about the aim of the study and its significance. Consent of the every nurse for their participation was obtained after explaining the aim of the study.

Before data collection all inexperienced nurse received instruction in the use of the GCS and FOU. Then, every patient was examined by 2 inexperienced nurses and the experienced nurse at the same time. GCS and FOU were measured every 6 hours for 3 times /day and repeated for 2 days by the same nurses.

The experienced nurse observed all procedures and made written notes on any departures from protocol as they occurred in checklist. Then when 2 nurses had dispersed, she made her own GCS and FOU observations.

### Data analysis:

Data was analyzed by using the Statistical Package for Social Science (SPSS version 16). The obtained data were coded, analyzed and tabulated. Descriptive analysis was performed in this study including frequencies, percentage, ANOVA and Kruskal-Wallis exact probability test.

### 3. Results:

Table (I) shows comparison between inexperienced and experienced nurse GCS and FOUR rating scores.

It can be noted that score of GCS which was obtained by inexperienced nurse was less than mean score of GCS which was obtained by experienced nurse during 2 days with significant difference at second day and total scores of the two days ( $p=0.02,0.02$ ) respectively.

Furthermore, It can be observed that score of FOUR which was obtained by inexperienced nurse was less than mean score of FOUR which was obtained by experienced nurse during 2 days with significant difference at second day and total scores of the two days ( $p=0.02,0.02$ ) respectively.

**Table (I): Comparison between inexperienced and experienced nurse GCS and FOUR rating scores:**

Scale	First day scores	Second day scores	Total scores
	X ±SD	X ±SD	X ±SD
<b>GCS</b>			
Inexperienced nurse	7.9 2.6	7.7 2.7	7.8 2.6
Experienced nurse	8.6 3.4	9.0 3.9	9.1 3.8
<b>P</b>	0.06	0.02*	0.02*
<b>FOUR</b>			
Inexperienced nurse	9.1 2.8	8.9 3	9 2.9
Experienced nurse	9.7 4.3	10.1 4.9	10.1 4.8
<b>P</b>	0.15	0.02*	0.02*

*P*: adjusted p value for repeated measures ANOVA  $P < 0.05$  (significant)

Figure (1) shows relation between GCS and FOURS rating scores of experienced and inexperienced nurse.

It can be noted that mean of GCS rating scores increased with mean of FOUR rating scores with both of inexperienced and experienced nurse.

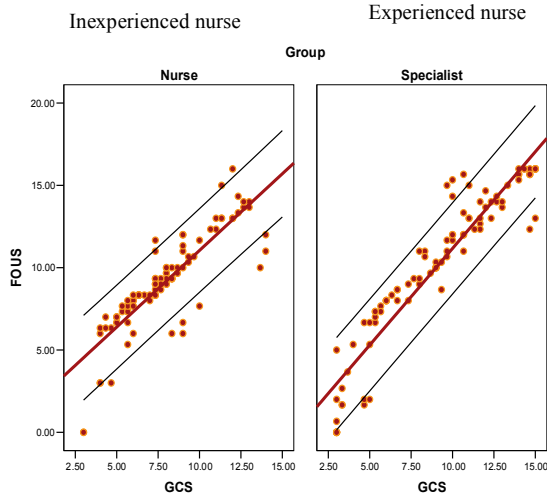
Moreover, there is no association between mean scores of GCS and FOUR of inexperienced and experienced nurse.

Figure (II) shows correlation between FOUR rating scores for both inexperienced and experienced nurse.

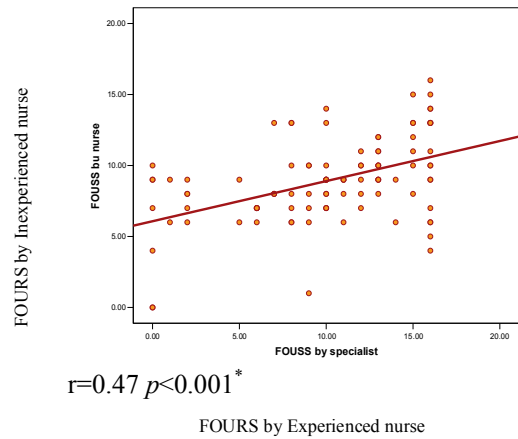
It can be noted that FOUR rating scores of inexperienced nurse was significantly correlated with FOUR rating score of experienced nurse ( $r=0.47$   $p<0.001^*$ ).

Figure (III) shows correlation between GCS rating scores for both inexperienced and experienced nurse.

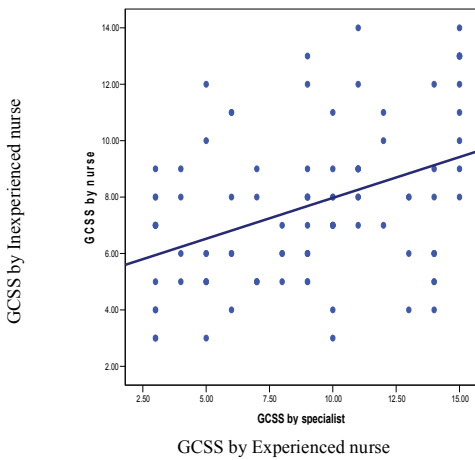
It can be noted that GCS rating scores of inexperienced nurse was significantly correlated with GCS rating score of experienced nurse ( $r=0.42$   $p<0.001^*$ ).



**Figure (I): Relation between GCS and FOURS rating scores of experienced and inexperienced nurse:**



**Figure (II): Correlation between FOUR rating scores of inexperienced and experienced nurse:**



**Figure (III): Correlation between GCS rating scores of inexperienced and experienced nurse**

Table (II) reveals frequency distribution of examined patients as regards to their demographic data.

It can be noted that about 2 quarters of the examined patients were 24% and 22% between > 40-50 years and more than 70 years old. Moreover, the majority of patients (60%) were males.

In addition, the medical diagnosis of 18% of patients was R.T.A, 16% was head injury, 14 % of them was stroke and 14% was shock.

Table (III) shows relation between GCS and FOUR rating score differences and patients' demographic data.

The median of GCS rating scores differences between experienced nurse recording scores and those were recorded by inexperienced nurse was more than 3 points with spinal cord injured patients (median= - 4) respectively with significant difference ( $p=0.05$ ).

**Table (II): Frequency distribution of examined patients as regards to their demographic data:**

Demographic data	No	%
<b>Age</b>		
18--30 years	4	8
> 30-40 years	9	18
> 40-50 years	12	24
> 50-60 years	6	12
> 60-70 years	8	16
More than 70 years	11	22
<b>Sex</b>		
male	30	60
female	20	40
<b>Diagnosis</b>		
Respiratory disease	4	8
Head injury	8	16
Spinal cord injury	2	4
Hepatic encephalopathy	2	4
Stroke	7	14
Cardiac disease	6	12
Shock	7	14
R.T.A	9	18
Poisoning	5	10

Moreover, The same finding was observed with the median of FOUR rating scores differences between experienced nurse recording scores and those were recorded by inexperienced nurse was more than 4 points with spinal cord injured patients, (median= - 4.5) respectively with significant difference ( $p=0.04$ ).

#### 4. Discussion:

It can generally be said that inexperienced nurses made proportionately less errors than experienced nurses. In spite of their GCS and FOUR scores were less than GCS and FOUR scores which obtained by experienced nurse during 2 days with significant difference at second day and total scores of the two days (Table I).

This finding can be supported with the other finding that there was no association between their scores and experienced nurse score (Figure I). Furthermore, their scores were correlated positively with scores of experienced nurse (Figure II and III). In addition, the results demonstrate that the inexperienced nurses, although maintaining a low score of GCS and FOUR the median of scores difference in the most of patients did not exceed 3

points for GCS and for points For FOUR table III. Because. Increasing of GCS scores up to 3 points or 4 points of FOUR score did not provide false interpretation of patient's condition.

The findings in this study provide the strongest support yet seen for the use of the GCS by experienced and highly trained observers in a previous study done by Teasdale's<sup>(8)</sup>. Teasdale's observers 6 nurses, 7 neurosurgeons, and 5 general surgical trainees had not been trained to use the GCS but were provided with standard definitions as guidance. Moreover, a previous study that use an expert observer and inexperienced nurses, such as this one and another by Ingersoll and Leyden<sup>(17)</sup> were found that that the GCS allows accurate assessment by both experienced and inexperienced staff.

**Table (III): Relation between GCS and FOUR rating score differences and patients' demographic data:**

Patients' demographic data	Rating scores differences					
	GCS			FOUS		
	Min.	Max.	Med.	Min.	Max.	Med.
<b>Age</b>						
18--30 years	-3	3	0	-1	3	2
> 30-40 years	-5	8	3	-9	11	3
> 40-50 years	-4	3	2	-7	3	2
> 50-60 years	-4	3	1	-8	4	2
> 60-70 years	-6	7	1	-5	6	1
More than 70 years	-4	5	0	-4	5	1
<sup>H</sup> P	0.13			0.35		
<b>Sex</b>						
Male	-5	8	2	-9	11	2
Female	-6	5	1	-5	6	2
<sup>H</sup> P	0.25			0.41		
<b>Diagnosis</b>						
Respiratory disease	0	8	2.5	0	11	3
Head injury	-2	5	1.5	-2	5	2
Spinal cord injury	-6	-4	-5	-5	-4	-4.5
Hepatic encephalopathy	5	7	6	5	5	5
Stroke	-5	2	-1	-8	2	-1
Cardiac disease	4	2	1	4	3	1.5
Shock	0	5	2	0	6	2
R.T.A	-5	3	2	-9	2	1
Poisoning	3	5	4	3	5	4
<sup>H</sup> P	0.05*			0.04*		

Min. Minimum, Max. Maximum, Med. Median  
 < 0.05 (significant) <sup>H</sup>P: Kruskal-Wallis test

Furthermore, in order to overcome deficiencies of the GCS, the FOUR score has been designed to provide further neurological details in coma patients, recognize certain unconscious states, and predict outcome<sup>(18)</sup>. Our study shows a good concurrent

validity between the FOUR score and GCS in line with previous finding<sup>(19)</sup>. In addition the result showed FOUR is easy to be clinically practiced by inexperienced nurse as the same as GCS.



The result of this study indicated that the median cores differences between experienced nurse recording scores and those were recorded by inexperienced nurse was more than 3 points for GCS and with more than 4 points for FOUR with spinal cord injured patients (Table III).

However all errors are serious and have potentially important clinical implications. But, if inexperienced nurses assess patients with lower score than experienced nurse is less harmful than assessing patients with higher scores. Higher scores could miss a mild weakness and chart it as normal power, as this could be the beginning of a patient's deterioration which could be reversible if identified early. It makes inexperienced nurses' assessment with higher score serious finding.

It is difficult to understand why there was significant difference with scores of spinal cord injured patients. But, there are several explanations of why mistakes can occur <sup>(20)</sup>:

1. There is a lack of knowledge of how to elicit the best response from those patients and how to interpret the result.

2. There is no clearly agreed standard criterion for each level on the scale which can be universally known and understood.

3. There is a difference in the quality of stimulus applied by different observers.

Furthermore, the study emphasis on overall neurological assessment and total scores and did not consider each assessment part (eye response, motor response, verbal response, pupil reaction) independently.

### 5. Conclusion:

Inexperienced nurses made neurological assessment by using GCS and FOUR accurately. The GCS is an important tool in the assessment of patients. But, there is no doubt that the FOUR provides an adequate initial assessment of patients with disturbed level of consciousness and it can be easily used by inexperienced nurse. Errors occurred in the assessment of spinal cord injured patients and an understanding of how these can occur will be important if the quality of nursing care is to be improved.

### Recommendations:

-These findings suggest that there is a need for improved training in performing assessments intensive and critical care nurses and education in understanding and interpreting assessment findings especially for spinal cord injured patients.

-Further study is needed to compare each part of GCS and FOUR independently

### References:

1. Laureys S, Celesia GG, Cohadon F, *et al.* Unresponsive wakefulness syndrome: a new name for the vegetative state or apallic syndrome. *BMC Med.* 2010;8: 68.
2. Giacino JT, Ashwal S, Childs N, *et al.* The minimally conscious state: definition and diagnostic criteria. *Neurology.* 2002;58: 349–53.
3. Schnakers C, Chatelle C, Majerus S, Gosseries O, De Val M, Laureys S. Assessment and detection of pain in noncommunicative severely brain-injured patients. *Expert Rev Neurother.* 2010;10:1725–31.
4. Demertzi A, Schnakers C, Ledoux D, *et al.* Different beliefs about pain perception in the vegetative and minimally conscious states: a European survey of medical and paramedical professionals. *Prog Brain Res.* 2009; 177:329–38.
5. Neatherlin J S, Brillhart B. Glasgow coma scale scores in the patient post-cardio-pulmonary resuscitation. *Journal of Neuroscience Nursing* 1988; 20(2): 104-109
6. Schiff ND, Rodriguez-Moreno D, Kamal A, *et al.* fMRI reveals large-scale network activation in minimally conscious patients. *Neurology.* 2005;64:514–23.
7. Laureys S, Perrin F, Bredart S. Self consciousness in non-communicative patients. *Conscious Cogn.* 2007;16:722–41. Discussion 742-725.
8. Teasdale G, Jennett B. Assessment of coma and impaired consciousness. A practical scale. *Lancet.* 1974;2:81–4.
9. Laureys S, Piret S, Ledoux D. Quantifying consciousness. *Lancet Neurol.* 2005;4:789–90.
10. Rordorf G, Koroshetz W, Efirid J, Cramer S. Predictors of mortality in stroke patients admitted to an intensive care unit. *Crit Care Med.* 2000; 28:1301–5.
11. Tien H, Cunha J, Wu S. Do trauma patients with a Glasgow Coma Scale score of 3 and bilateral fixed and dilated pupils have any chance of survival? *J Trauma.* 2006;60:274–8.
12. Stocchetti N, Citerio G, Maas A, Andrews P, Teasdale G. Bryan Jennett and the field of traumatic brain injury. His intellectual and ethical heritage in neuro-intensive care. *Intensive Care Med.* 2008;34:1774–8. 95.
13. Balestreri M, Czosnyka M, Chatfield DA, *et al.* Predictive value of Glasgow Coma Scale after brain trauma: change in trend over the past ten years. *J Neurol Neurosurg Psychiatry.* 2004; 75: 161–2.
14. Gill M, Windemuth R, Steele R, Green SM. A comparison of the Glasgow Coma Scale score to

- simplified alternative scores for the prediction of traumatic brain injury outcomes. *Ann Emerg Med.* 2005;45:37–42.
15. Wijdicks EF, Bamlet WR, Maramattom BV, Manno EM, McClelland RL. Validation of a new coma scale: the FOUR score. *Ann Neurol.* 2005;58:585–93.
  16. Ingersoll GL, LeyAden DB. The Glasgow coma scale for patients with head injuries. *Crit Care Nurse* 1987; 7: 26-32.
  17. Wolf CA, Wijdicks EF, Bamlet WR, McClelland RL: Further Validation of the FOUR score coma scale by intensive care nurses. *Mayo Clinic Proceedings* 2007, 82:435-438.
  18. Iyer V, Mandrekar J, Danielson R, Zubkov A, Elmer J, Wijdicks E: Validity of the FOUR score coma scale in the medical intensive care unit. *Mayo Clin Proc* 2009, 84:694-701.
  19. Anne E and Stephen C. Aspects of neurosurgical assessment by using the Glasgow Coma Scale. *intensive and Critical Care Nursing* (1992) 8,9&99.

1/23/2015