간호학의 지평, 제8권, 제1호, 2011년 6월
Perspectives in Nursing Science Vol. 8, No. 1, 54-61, June, 2011

The Accuracy of Glasgow Coma Scale Knowledge and Performance among Vietnamese Nurses

Nguyen Thi Hien[1] · Sun-Mi Chae[2]

[1]Lecturer, MSN, RN, The Nursing Department, University of Medicine and Pharmacy, Vietnam,
[2]Assistant Professor, PhD, RN, CPNP-PC, College of Nursing · The Research Institute of Nursing Science, Seoul National University

Purpose: The purpose of this study was to investigate the accuracy of Glasgow Coma Scale (GCS) knowledge and performance among Vietnamese nurses. **Methods:** A cross-sectional descriptive study was conducted using a questionnaire pertaining to the nurses' knowledge of GCS and a structured evaluation tool to measure the accuracy of their GCS scores. A total of 94 Vietnamese nurses participated in this study, all from a general hospital in Ho Chi Minh City, Vietnam. Data were analyzed by conducting a t-test, a x^2 test, and ANOVA. **Results:** This study found that the vast majority of the nurses (>90%) responded correctly to questions regarding their GCS basic knowledge; however, 52.1% of the nurses answered incorrectly questions related to clinical scenarios requiring the application of the basic knowledge. Regarding the GCS performance, the nurses demonstrated acceptable accuracy rates for each component of GCS, but those who scored well in all three components accounted for only 42.6% of the subject group. These findings indicate that the Vietnamese nurses are not able to integrate their GCS knowledge into actual practice as measured by the accuracy of GCS scoring. **Conclusion:** This study suggests that new educational strategies should be developed for the Vietnamese nurses to improve their performance on accurate GCS scoring based on theoretical knowledge.

Key Words: Glasgow Coma Scale, Knowledge, Performance, Nurses

INTRODUCTION

Assessment of consciousness level is considered as a primary action of health care practitioners, including nurses, who care for the patients with neurological or neurosurgical problems. The assessment not only identifies the neurological problem but also detects the initial signs of complications. It can be an indicator of intervention or treatment in emergency conditions (Weir, Bradford, & Lees, 2003). The Glasgow Coma Scale (GCS), first presented by Teasdale and Jennet in 1974, is one of the most effective and reliable tools to assess the depth and duration of impaired consciousness, especially for the patient with head injuries. The high level of validity and reliability of GCS ensure its assessment accuracy in comparison with other earlier scoring systems such as the anatomical or physiological scoring system and the revised trauma score (Fisher & Mathieson, 2001; Kingston & O'Flanaga, 2000). None of the alternative methods, even the recently developed Alert, Confused, Drowsy, Unresponsive (ACDU) scale and the Alert, Response to Voice, Response to Pain, Unresponsive (AVPU) scale, have been shown to equal the capacity for reliable and practical use with GCS (McNarry & Golhill, 2004). The usefulness, reliability, and practicality of GCS have been confirmed through previous studies (Juarez & Lyons, 1995; Rowley & Fielding, 1991).

GCS consists of three components: eye opening, verbal responsiveness, and motor responsiveness. It uses numeric system to minimize variation and subjectivity in clinical assessment (Lacono & Lyons, 2005; Norwood, McAuley, Berne, Creath, & McLarty, 2002; Shah, 1999).The total score of GCS ranges from 3 to 15. Since it was developed, GCS has been world-widely used because it

Corresponding author: Sun-Mi Chae, College of Nursing, Seoul National University, 28 Yeongeon-dong, Jongno-gu, Seoul 110-799, Korea.
Tel: 82-2-740-8816, Fax: 82-2-874-8965, E-mail: schae@snu.ac.kr

- This article is a condensed form of the first author's master's thesis from Ajou University.

투고일 2011년 5월 6일 / 심사완료일 2011년 5월 28일 / 게재확정일 2011년 6월 9일

enhances communication among health care practitioners through a common reporting language, despite its simple appearance. Because of the apparent simplicity of GCS, a lot of health care practitioners have used it in an inappropriate way without careful referring to the GCS instruction. Previous studies reported a variety of health care providers used GCS inaccurately and ineffectively in their clinical practice (Bazarian, Eirich, & Salhanick, 2003; Iankova, 2006; Zuercher, Ummenhofer, Baltussen & Walder, 2009).

Because inaccurate performance of GCS scoring may lead to deteriorate a patient's outcome, it is crucial to ensure complete practice of GCS. There are a few factors that affect accuracy of GCS scoring. Heron, Davie, Gillies & Courtey (2001) compared GCS scorings among nurses working in different units. They reported that the nurses with a specific qualification from critical care training performed GCS accurately. Unstable condition of patients and inadequate GCS knowledge and experience of physicians and nurses also had an effect on the accuracy of GCS scoring (Holdgate, Ching & Angonese, 2006). These findings indicate the positive relationship of GCS knowledge with accurate GCS scoring. However, previous studies have merely investigated either knowledge of GCS in health care professionals (Heim, Schoettker, Gilliard, & Spahn, 2009; Riechers et al., 2005) or inter-reliability of GCS in practice between different health care professionals (Arbabi et al., 2004; Holdgate et al., 2006; Menegazzi, Davis & Paris, 1993; Rowley & Feilding, 1991). Very few studies are known to measure the relationship of GCS knowledge and performance among nurses, especially no studies in Vietnam.

GCS is also widely used in Vietnam like other countries in the world to assess their patients' consciousness level. However, the Vietnamese nurses generally have no preparations for using the assessment tool. GCS is simply introduced as a tool for level of consciousness in most of the Vietnamese nursing schools. Similarly, in clinical settings, new nurses receive GCS-related information via words of experienced nurses. There is no well-structured education on GCS for these nurses. Most Vietnamese nurses practice GCS scoring by depending on their own understanding. Therefore, this study will make a significant contribution by exploring the accuracy of GCS usage in Vietnamese nurses. Consequently, it could stimulate both nursing schools and hospitals to develop a comprehensive GCS education program so that nurses have satisfactory preparations to provide a high quality of care.

Purpose of study

The purpose of this study was to determine the accuracy of GCS knowledge and performance among Vietnamese nurses. The specific aims of the study were: 1) to identify the accuracy of knowledge on GCS; 2) to identify the accuracy of GCS performance; 3) to examine the difference in knowledge on GCS between the groups with incorrect and correct performance; and 4) to examine the difference in knowledge and performance of GCS scoring by general characteristics.

METHODS

1. Study design

This was a cross-sectional descriptive study identifying the GCS knowledge and performance among the Vietnamese nurses.

2. Participants of the study

The convenience sampling method was used to recruit the study's participants at the neurology ward, neurosurgical department, and neurosurgery intensive care unit (NCU) in CR Hospital located in Ho Chi Minh City, Vietnam. The inclusion criteria for participants of this study were: nurses 1) working in the hospital who graduated from a two-year or longer education program; 2) caring for adult patients who suffered from head injury or neurological pathology, and were eligible for GCS scoring; and 3) volunteering to participate in this study. The exclusion criteria were: 1) nurses who graduated from a one-year educational program, 2) assistant physicians with three months of nursing education, and 3) nurses with less than one year of working experience. A total of 94 nurses who met the study criteria participated in the study.

3. Instruments

1) Questionnaire on GCS Knowledge

The questionnaire used to evaluate the knowledge of nurses regarding GCS was designed by Heim and her colleague (2009). Permission for the questionnaire was obtained from the author via e-mail. The questionnaire was originally developed to evaluate air rescuers' knowledge of GCS scoring. It was translated to Vietnamese by the researcher and confirmed the accuracy of its translation by a nursing lecturer who was fluent in both lan-

guages. Then the Vietnamese version was translated back to English by two other experts who studied nursing abroad and had nursing experience in Vietnam. A panel of 4 experts compared the two versions and reached an agreement on the same meaning in the English and Vietnamese versions. After the completion of translation, a pilot test was conducted to confirm the accuracy and clarity of the translated questionnaire. Five experienced nurses working in a neurosurgery ward in Vietnam answered all the questions on the translated questionnaire. They were able to complete the questionnaire without any questions to clarify.

The questionnaire consists of two parts including six questions regarding GCS knowledge. The first section of the questionnaire tested general knowledge on GCS, such as number of the GCS components, and name and score of each component. The other section of the questionnaire describes a clinical scenario that requires application of theoretical knowledge on GCS. The responses were scored as "1" for a correct answer and "0" for a wrong answer to each question. The range of possible score is 0 to 6. A higher score indicates a higher knowledge on GCS. The reliability coefficient, KR-20, for the Vietnamese version in this study was 0.60.

2) The evaluation form of GCS performance

The evaluation form includes 3 components of GCS, eye opening, verbal response, and motor response. Both the nurses and the researcher used the same form to assess the consciousness level of the patients and provided a score of each component in GCS, including the total score. The scores measured by the researcher were used as a norm.

4. Data collection

Data were collected from July to August, 2010 at CR hospital in Ho Chi Minh City, Vietnam after obtaining permission from the hospital. Before collecting data, the researcher was trained on GCS scoring at a university hospital in Korea and validated her knowledge and performance of GCS in order to provide expert scores as a norm for GCS scoring. The 10-hour GCS training was supervised by an advanced practice nurse (APN) who had a specialty in neurosurgery and vast experience of caring patients with neurosurgical problems for more than 10 years. The APN and the researcher reached agreements of 84% in all 30 cases of GCS scoring. The same process was repeated with an experienced neurosurgery physician in CR hospital, Vietnam, and they achieved high agreement as well (82%).

Nurses who agreed to participate in the study completed general information. Then, the nurses had to answer all of the questions in the questionnaire independently in a limited amount of time (15 minutes) proctored by the researcher. The nurses were not informed of the results to ensure the objectivity of other participants until the data collection was completed. The nurses who completed the questionnaire performed GCS scoring on a patient assigned by the researcher. The researcher also concurrently evaluated the consciousness level of the same patients with the nurses.

1) Data Analysis

The collected data were analyzed using SPSS/WIN Version 17.0. Descriptive statistics were used to demonstrate the nurses' general characteristics, the accuracy of their knowledge, and their GCS scoring performance. The t-test was used to examine the difference in knowledge between the correct and incorrect performance groups. ANOVA and the x^2 test were used to measure the differences in knowledge and performance by the nurses' general characteristics. The comparisons of group means when significant differences occurred were conducted by using post hoc analysis with the Least Significant Difference (LSD) test.

2) Ethical Consideration

Study permission was obtained from the hospital before data were collected. The researcher explained the purposed of the study and their rights as a study participant, including anonymity and confidentiality, their right to withdraw from the study at any time and right to reject answering any questions they didn't want to the eligible nurses. Signed consent forms were received from the nurses participating in the study.

RESULTS

1. General characteristics of the participants

Of all the participants, female nurses outnumbered (n=83, 88.3%) male nurses. The age of the nurses ranged from 20 to 51 years; over half (n=61, 64.9%) were less than 30 years old. Similarly, about a third of the nurses (n=33, 35.1%) had less than two years of working experience. About one third of the nurses were from NCU (n=29, 30.9%), and the others from the neurosurgery, neurology, or head injury unit. In terms of their educational background, the vast majority of nurses graduated

from a two-year nursing program (n=86, 91.5%). Most of the nurses received GCS information at school (n=63, 67.0%); still one third of the nurses obtained the information from the hospital. All the nurses felt confident regarding GCS scoring and believed that GCS assessment was very important in treatment and patient care (Table 1).

Table 1. General Characteristics of the Participants (N=94)

Characteristics	Categories	n (%)
Gender	Male	11 (11.7)
	Female	83 (88.3)
Age (year)	20~25	21 (22.3)
	26~30	40 (42.6)
	>31	33 (35.1)
Working experience (year)	1~2	33 (35.1)
	3~7	32 (34.0)
	>7	29 (30.9)
Working unit	Neurosurgery-3B1	19 (20.2)
	Neurosurgery-3B3	23 (24.5)
	Head injury	17 (18.1)
	NCU	29 (30.9)
	Neurology	6 (6.4)
Educational background	2-year program	86 (91.5)
	3-year program	5 (5.3)
	4-year program	3 (3.2)
GCS education history	From school	63 (67.0)
	From hospital	31 (33.0)
Level of confidence	Very confident	78 (83.0)
	A little confident	16 (17.0)

Note. Neurosurgery-3B1: Neurosurgery unit for female & pediatric patients; Neurosurgery-3B3: Neurosurgery unit for male patients.

2. Accuracy of GCS knowledge

Nearly all of the Vietnamese nurses had correct knowledge on GCS for the first 5 questions: number of GCS components, name and score of each component, and minimum and maximum values in GCS (Table 2). Of these 5 questions, almost one third of the nurses (n=27, 28.7%) answered incorrectly on the question about the name of each component. Comparing to the first 5 questions, the Vietnamese nurses showed lower correct answer rate regarding the clinical scenario question: less than a half (n=45, 47.9%) had correct answer. The mean total score and the standard deviation were 5.03 and 0.82, respectively.

Table 2. Accuracy of GCS Knowledge (N=94)

Items	Right answer	Wrong answer
	n (%)	n (%)
Question 1. Number of the GCS components	92 (97.9)	2 (2.1)
Question 2. Name of each component	67 (71.3)	27 (28.7)
Question 3. Score of each component	89 (94.7)	5 (5.3)
Question 4. Minimum value of GCS	94 (100.0)	0 (0.0)
Question 5. Maximum value of GCS	92 (97.9)	2 (2.1)
Question 6. Clinical scenario	45 (47.9)	49 (52.1)

3. Accuracy of GCS performance

Each participant's assessment results were classified as either correct or incorrect by comparison to the score given by the researcher. Table 3 shows accuracy of GCS performance by the participants. The highest agreement between the nurses and the researcher was found in motor evaluation (n=74, 78.7%) followed by the components of verbal response (n= 71, 75.5%) and eye opening (n=64, 68.1%). While each component presented high correct performance rate regardless of the other components, the correct performance for all 3 components were much lower than each component, 42.6% (n=40).

Table 3. Accuracy of GCS Performance (N=94)

GCS components	Correct performance	Incorrect performance
	n (%)	n (%)
Eye opening	64 (68.1)	30 (31.9)
Verbal response	71 (75.5)	23 (24.5)
Motor response	74 (78.7)	20 (21.3)
All three components	40 (42.6)	54 (57.4)

4. Difference in GCS knowledge between correct and incorrect performance groups

To examine the difference in knowledge between correct and incorrect performance of GCS, t-test analysis

was performed. The correct performance group (5.38±0.82) had a higher mean score than the incorrect group (4.78±0.71), which was statistically significant (t=3.71, p=.001) (Table 4).

Table 4. GCS Knowledge between Correct and Incorrect Performance Groups (N = 94)

Variables	Correct group (n=40) M±SD	Incorrect group (n=54) M±SD	t	p
GCS knowledge	5.38±0.83	4.78±0.71	3.71	.001

5. Differences in GCS knowledge and performance by general characteristics

Among the variables of general characteristics, gender and working unit showed a significant difference in knowledge (Table 5). Female nurses had significantly higher knowledge than males (t=2.877, p=.02). The nurses working at NCU had significantly higher knowledge than the neurosurgery (3B1), head injury, or neurology departments (F=11.92, p=.01). Table 6 shows difference in performance by general characteristics. There was no statistically significant difference in performance by general characteristics.

DISCUSSION

This is the first study in Vietnam to examine the accuracy of GCS knowledge and performance among nurses. All the Vietnamese nurses in this study perceived that GCS was very important in treating patients, and felt confident when they used GCS to assess the levels of consciousness. In a study on third year nursing students, only 64% of the students felt it was a very important scale in the neurological field, and an extremely low percentage (15%) felt very confident in GCS practice (Shoqirat, 2006). These results imply that more experiences in clinical settings will likely lead to higher confidence and belief in GCS scoring.

Although Vietnamese nurses regularly use GCS in their nursing practice, their knowledge and performance of GCS have not been validated. Our results demonstrated the Vietnamese nurses presented fairly good knowledge on the structure of GCS but were lack of knowledge to a clinical case. The nurses in this study presented higher rate of incorrect answer (28.7%) for the question on name of each component while only 5.8% of air rescue physicians made errors in the study of Heim et al. (2009). In addition, more than half of the nurses (52.1%) gave the wrong answer on the clinical scenario question; one third of the physicians scored incorrectly in the previous study (Heim et al.). These differences may have been derived from lack of systematic education on GCS for nurses or nursing students in Vietnam. Lack of GCS education was also emerged from this study showing low accuracy on the question of clinical scenario. The vast majority of the nurses in the study were graduates from 2-year nursing programs, which is a very common phenomenon in Vietnamese hospitals. Two-year nursing programs rarely provide satisfactory experiences of knowledge and practice on GCS scoring to the nursing students. A systematic education on GCS needs to be included in Vietnamese nursing curriculum to improve the accurate knowledge on GCS including application ability of the basic GCS knowledge to clinical cases.

The Vietnamese nurses performed moderate accuracy in each GCS component, which is similar to or higher than the results from previous studies (Holdgate et al., 2006; Zuercher et al., 2009). However, our study found that less than a half of the Vietnamese nurses showed correct performance in all 3 components whereas more than two thirds of them correctly performed on each component separately. This result indicates that the Vietnamese nurses correctly measure certain GCS components, but not all. It reflects their deficient knowledge on GCS that was not able to apply to the clinical scenario. They may have hardly integrated their understanding of GCS. They need to cultivate their performance of all three GCS components through a well- designed practical training of GCS scoring under the supervision of experts on GCS.

Our results confirm that more accurate knowledge can contribute to correct performance of GCS. The correct performance group of GCS had significantly higher accurate knowledge on GCS than the incorrect performance group. It also ensures the importance of effective education or training for nurses. Continuing education for using GCS was emphasized in the study of Watson, Horn, and Curl (1992). They found that the more education the medical staff received regarding GCS knowledge, the more accurately they would perform. Practice training sessions by experts are highly effective because they provide standardized methods for measuring GCS to improve accuracy in using it.

When comparing the differences in GCS knowledge by general characteristics of the participants, there was a statistically significant difference among the nurses work-

Table 5. Differences in GCS Knowledge by General Characteristics

Characteristics	Categories (n)	M±SD	t or F	*p*	Post-hoc
Gender	Male (11) Female (83)	4.64±1.28 5.08±0.73	2.877	.02	
Age (year)	20~25 (21) 26~30 (40) >31 (33)	4.95±0.66 5.00±0.98 6.12±0.69	0.657	.62	
Working experience (year)	0~2 (33) 3~7 (32) >7 (29)	4.97±2.39 7.78±2.32 6.67±2.08	0.347	.84	
Working unit	Neurosurgery-3B1[a] (19) Neurosurgery-3B3[b] (23) Head injury[c] (17) NCU[d] (29) Neurology[e] (6)	5.00±0.90 5.17±0.75 4.75±0.96 5.27±0.875 4.84±0.50	11.920	.01	d>a*; d>c**; d>e**
GCS information	From school (63) From hospital (31)	5.03±0.76 5.00±0.98	0.691	.60	
Religion	Yes (40) No (54)	4.75±0.88 5.06±0.87	1.053	.38	
Marital status	Married (53) Single (41)	5.06±0.79 5.00±0.86	0.689	.60	

Note. Neurosurgery-3B1: Neurosurgery unit for female & pediatric patients; Neurosurgery-3B3: Neurosurgery unit for male patients.
*p<.05; **p<.01.

Table 6. Differences of Performance by General Characteristics

Characteristics	Categories (n)	Correct performance (n)	Incorrect performance (n)	x^2	*p*
Age (year)	20~25 (21) 26~30 (40) >31 (33)	8 17 15	13 23 18	0.28	.86
Working experience (year)	0~2 (33) 3~7 (32) >7 (29)	7 9 8	12 14 9	1.94	.74
Working unit	Neurosurgery-3B1 (19) Neurosurgery-3B3 (23) Head injury (17) NCU (29) Neurology (6)	12 4 10 17 13	17 2 23 15 16	3.55	.16
GCS information	From school (63) From hospital (31)	27 13	36 18	4.58	.10
Religion	Yes (40) No (54)	16 24	31 24	2.20	.32
Marital status	Married (53) Single (41)	23 17	30 24	0.03	.85

Note. Neurosurgery-3B1: Neurosurgery unit for female & pediatric patients; Neurosurgery-3B3: Neurosurgery unit for male patients.

ing in different units. However, Arbabi et al. (2004) reported different results from our study, presenting higher accuracy in the patients with lower severity of the patient's status. Considering the severity of the patient's status in NCU, the nurses working in NCU would demonstrate lower accuracy than those in general wards who cared for the patients with better condition. The NCU nurses in this study may have had more specialized knowledge and skills caring for the patients in critical condition, which could explain their higher accuracy in GCS knowledge than others. Further studies may need to examine the relationship between the accuracy in GCS knowledge and working units. Meanwhile a working unit did not affect the GCS performance in the nurses: GCS knowledge of the NCU nurses were not enough to correctly outperform GCS than the other nurses. Hence practical training of GCS scoring should be entailed in a GCS education program for the Vietnamese nurses in order to make them competent in relation to both GCS knowledge and performance.

Limitations

There are several limitations in interpreting our results. First, using a convenience sample makes the findings of this study less generalizable to the whole Vietnamese nurses. In addition, due to the unbalanced sample in terms of an educational background, although it is a very common phenomenon in Vietnam, it was not able to compare the outcomes of nurses by their educational background. Future studies may need to investigate GCS knowledge and performance among the nurses with different educational background. Lastly, the researcher's knowledge and practice of GCS were trained and validated by an expert to be a norm for the Vietnamese nurses; however, an objective method to measure GCS performance might have been necessary to complement the subjectivity of GCS scoring. Despite these limitations, our findings elucidate the importance of a systematic education of GCS including practical training for the Vietnamese nurses.

CONCLUSION

GCS is a reliable and valid tool to measure the level of consciousness. Nursing professionals are responsible for ongoing monitoring and identification of altered consciousness level in patients. Hence it is vital for nurses to acquire accurate knowledge and skills in using GCS. The findings of this study point out the gap between the theoretical knowledge and performance of GCS in the Vietnamese nurses. Although most Vietnamese nurses had suitable theoretical knowledge of the GCS, they were not able to apply it to analyze a clinical situation. Furthermore their basic knowledge of GCS was not enough to ensure accurate performance of GCS scoring. Therefore this study suggests that a well-developed GCS training program should be delivered to the Vietnamese nurses to contain accuracy of assessment of the consciousness level using GCS, which ultimately results in improving the quality of nursing care.

REFERENCES

Arbabi, S., Jurkovich, G. J., Walh, W. L., Franklin, G. A., Hemmila, M. R., Taheri, P. A., et al. (2004). A comparison of prehospital and hospital data in trauma patients. *Journal of Trauma, 56*, 1029-1032.

Bazarian, J. J., Eirich, M. A., & Salhanick, S. D. (2003). The relationship between pre- hospital and emergency department Glasgow Coma Scale score. *Brain Injury, 17*(7), 553-560.

Fisher, J., & Mathieson, C. (2001). The History of the Glasgow Coma Scale: implications for practice. *Critical Care Nurse, 23*(4), 52-58.

Heim, C., Schoettker, P., Gilliard, N., & Spahn, D. R. (2009). Knowledge of Glasgow Coma Scale by air-rescue physicians. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 17*(39), 1-6.

Heron, R., Davie, A., Gillies, R., Courtey, M. (2001). Interrater reliability of the Glasgow Coma Scale scoring among nurses in sub-specialities of critical care. *Australia Critical Care, 14*(3), 101-105.

Holdgate, A., Ching, N., & Angonese, L. (2006). Variability in agreement between physicians and nurses when measuring the Glasgow Coma Scale in the emergency department limits its clinical usefulness. *Journal of Emergency Medicine Australasia, 18*(4), 379-384.

Iankova, A. (2006). The Glasgow Coma Scale clinical application in emergency departments. *Emergency Nurse, 14*(8), 31-35.

Juarez, V. J., & Lyons, M. (1995). Interrater reliability of the Glasgow Coma Scale. *Journal of Neuroscience Nursing, 27*, 283-286.

Kingston, R., & O'Flanagan, S. J. (2000). Scoring system in trauma. *Irish Journal of Medicine Science, 169*(3), 168-172.

Lacono, L. A., & Lyons, K. A. (2005). Making GCS as easy as 1, 2, 3, 4, 5, 6. *Journal of Trauma Nursing, 12*(3), 77-81.

Menegazzi, J. J., Davis, E. A., & Paris, P. M. (1993). Reliability of

the Glasgow Coma Scale when used by emergency physicans and paramedics. *Journal of Trauma, 34*, 46-48.

McNarry, A. F., & Golhill, D. R. (2004). Simple bedside assessment of level of consciousness: comparison of two simple assessment scales with the Glasgow coma scale. *Anaesthesia, 59*, 34-37.

Norwood, S. H., McAuley, C. E., Berne, J. D., Creath, R. G., & McLarty, J. (2002). A prehospital Glasgow Coma Scale score < or = 14 accurately predicts the need for full trauma team activation and patient hospitalization after motor vehicle collisions. *Journal of Trauma, 53*(3), 503-507.

Riechers, R. G., Ramage, A., Brown, W., Kalehua, A., Rhee, P., Ecklund, J. M., et al. (2005). Physician knowledge of the Glasgow Coma Scale. *Journal of Neurotrauma, 22*(11), 1372-1334.

Rowley, G., & Feilding, K. (1991). Reliability and accuracy of the Glasgow Coma Scale with experienced and inexperienced users. *Lancet, 337*, 535-538.

Shah, S. (1999). Neuro assessment. *Nursing Standard, 13*(22), 49-54.

Shoqirat, N. (2006). Nursing students' understanding of the Glasgow Coma Scale. *Nursing Standard, 20*(30), 41-47.

Watson, M., Horn, S., & Curl, J. (1992). Searching for signs of revival. Uses of the Glasgow Coma Scale. *Professional Nurse, 7*(10), 670-674.

Weir, C. J., Bradford, A. P. J., & Lees, K. R. (2003). The prognostic value of the components of the Glasgow Coma Scale following acute stroke. *The Quarterly Journal of Medicine, 96*, 67-74.

Zuercher, M., Ummenhofer, W., Baltussen, A., & Walder, B. (2009). The use of Glasgow Coma Scale in injury assessment: A critical review. *Brain Injury, 23*(5), 371- 384.