

# Precision and Reliability of the Glasgow Coma Scale Score among a Cohort of Latin American Prehospital Emergency Care Providers

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## Abbreviations:

GCS = Glasgow Coma Scale  
EMS = emergency medical services

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## Abstract

**Introduction:** The Glasgow Coma Scale (GCS) is the standard measure used to quantify the level of consciousness in patients with head injuries. Rapid and accurate GCS scoring is essential for adequate assessment and treatment of critically sick and injured patients. This study sought out to determine the precision and reliability of the GCS among a cohort of Latin American Critical Care Transport Providers.

**Methods:** The study consisted of a cross-sectional design using an Internet-based examination. The evaluation consisted of four focused clinical scenarios with a classification based on severity. For measurement of intra-rater reliability the first and fourth cases were identical. Five minutes were allocated for each scenario. For categorical variables, chi-square testing and Fisher's exact testing were used to assess associations. For all tests, statistical significance was set at the 0.05 level.

**Results:** A total of 62 providers participated, including 17 physicians and 45 advanced providers (nurses and paramedics). No statistically significant differences were observed between physicians and advanced providers in the correct classification of the individual scenarios. Five of the 17 physicians (29.4%) answered all cases correctly, while none of the 45 advanced providers did ( $p < 0.001$ ). When evaluating the duplicated cases (Cases 1 and 4), five physicians (29.4%) and 11 advanced providers (24.4%) correctly classified the cases. This difference was not statistically significant.

**Conclusions:** This study demonstrated a poor precision and poor reliability in the use of the Glasgow Coma Scale within the study subjects.

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## Introduction

The Glasgow Coma Scale (GCS) is the most widely used scoring system for quantifying the level of consciousness following traumatic brain injury. It is used primarily because of its simplicity, its high degree of inter-observer reliability, and its correlation with outcomes following severe brain injury. The GCS is a key component of scoring systems, treatment protocols, and general clinical decision-making in critically ill patients. Rapid and accurate GCS scoring is essential for the adequate assessment and treatment of the critically sick and injured patient. The GCS rates three categories of patient responses: eye opening (E), best motor response (M), and best verbal response (V). Levels of responses indicate the degree of nervous system or brain impairment. To obtain the GCS score, these categories are summed for a total of 3–15 (E + M + V). This study sought to determine the precision and reliability of the use of the GCS among a cohort of Latin American prehospital care providers.

## Methods

The study consisted of a cross-sectional design using an Internet-based examination, which received approval from an ethical committee. Latin American prehospital care providers were invited to participate in the study by means of

	Number of Participants n(%)
EMT-I	3 (4.8)
EMT-P	23 (37.1)
Registered Nurse	19 (30.6)
Physicians	17 (27.4)
<b>Total</b>	<b>62 (100)</b>

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**Table 1**—Study subjects level of training (n = 62; EMT = emergency medical technician; -I = Intermediate; -P = paramedic

Internet-based, emergency and prehospital care, Spanish forums. The study was conducted from January 2003 to September 2003. The evaluation consisted of four focused clinical scenarios with a classification based on severity: mild/normal (GCS score 14–15), moderate (GCS score 11–13), and severe (GCS score <11). At the end of each scenario, a question on the correct categorization and scoring of the intubated patient was included. For measurement of intra-rater reliability, the first and fourth cases were identical. Five minutes were allocated for each scenario. Descriptive statistics were used to present group characteristics. For categorical variables, chi-square ( $\chi^2$ ) testing and Fisher's exact testing were used to assess associations. The Student's *t*-test was used to assess associations between continuous variables. Relative Risk (RR) was used as the measure of strength of association. For all tests, statistical significance was set at the 0.05 level. All analyses were performed with SPSS® for Windows 9.01 Standard version (SPSS Inc., Chicago, 1989–1999).

#### Participants and Setting

The participants were classified as physicians or advanced emergency medical services providers. This latter group included paramedics (EMT-P), EMT-Intermediates (EMT-I), and registered nurses (RNs). For comparative analysis, physician responses were used as the "gold standard" in scoring.

#### Results

A total of 62 providers participated in the study (Table 1), consisting of 17 physicians and 45 advanced providers. No statistical differences were observed between the physicians and the advanced providers in the correct classification of the individual scenarios (Table 2): In Case-1, the GCS score was 13 ( $p = 0.32$ ); in Case-2, six ( $p = 0.90$ ); in Case-3, 15 ( $p = 0.28$ ); and in Case-4, 13 ( $p = 0.65$ ). Five of the 17 physicians (29.4%) answered all cases correctly while none of the 45 advanced providers did. This poor general precision demonstrated a statistically significant difference between both study groups ( $p < 0.001$ ). When evaluating the duplicated cases (Cases 1 and 4), five physicians (29.4%) and 11 advanced providers (24.4%) correctly clas-

Case Number	Case Description	Total GCS
1	Paciente femenina de 30 años que se presenta a sala de emergencias luego de un trauma por accidente de vehiculo motor. Se muestra confundida, abre los ojos espontaneamente y puede localizar el dolor.	13
2	Paciente masculino de 55 años se presenta a la sala de emergencias haciendo sonidos incompresibles, muestra flexion al estimulo doloroso y no abre los ojos al ser estimulado.	6
3	Paciente masculino de 25 años se presenta orientado, abre los ojos espontaneamente y obedece comandos verbales.	15
4	Paciente femenina de 60 años de edad se presenta luego de una caida, confundida, abre los ojos espontaneamente y puede localizar el dolor.	13

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**Table 2**—Case vignettes description (in Spanish)

sified the cases. This difference was not statically significant [ $p = 0.69$ ;  $R^2 = 1.20$  (95% CI = 0.49 to 2.95)]. Of the 62 evaluated subjects, no one correctly indicated the appropriate category for the verbal component in intubated patients.

#### Discussion

The GCS first was published by Teasdale and Jennet in 1974.<sup>1</sup> This first version was modified in 1976 by changing the motor component to include withdrawal.<sup>2</sup> Today, the GCS has become an important component in physiologic scoring systems and the clinical assessment of neurological status has an important role in the prehospital management and triage of the injured patients. Currently, it is used in all phases of clinical care from out-of-hospital to the Intensive Care Unit, playing an important role in clinical algorithms,<sup>6</sup> severity indices,<sup>7–9</sup> and as an outcome assessment tool.<sup>10–13</sup> The GCS is an important component of the American College of Surgeons Field Triage Protocols,<sup>3</sup> the Trauma Score,<sup>4</sup> and in the Revised Trauma Score.<sup>5</sup>

Several studies have examined at the reliability and accuracy of the GCS score.<sup>14–17</sup> Crossman *et al* found that only 51% (42 of 82) of the patients referred to a neurosurgical unit had a correct score.<sup>14</sup> In another study Menegazzi *et al*<sup>15</sup> looked at the scoring skills of 19 university-affiliated emergency physicians and 41 professional paramedics in an urban EMS system, and found statistically significant agreement for the GCS scoring between emergency physicians and paramedics. Level of training and level of experience also has been shown to influence the accuracy of the GCS score; Rowley *et al*<sup>16</sup> found that the accuracy of the GCS score varied depending on experience. To the best of

the author's knowledge, no other study has focused on the GCS assessment skills of providers in Latin America.

In the current study, no statistically significant differences were observed between physician scoring and advanced providers. This study demonstrates poor precision and poor reliability in the use of the Glasgow Coma Scale within the study subjects. In 2002, Lane *et al* demonstrated that a short educational intervention favorably improved the GCS scoring skills in a cohort of prehospital care providers in the United States,<sup>17</sup> perhaps future research

should focus in the development and evaluation of educational tools directed to the Latin American provider. The limitations of this study include the number of subjects as well as the potential for self-selection bias. Country-specific data were not obtained; thus, it is difficult to assess accuracy of scoring as it related to different countries and regions.

### Conclusions

Despite the importance of the use of the GCS, the precision and reliability of its use is poor. Additional education and training should be implemented.

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