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Comparison Between Full Outline Unresponsiveness Score and Glasgow Coma Scale in Predicting Patient Outcome with Neurological Disorder in Intensive Care Units: A Prospective Observational Cross-Sectional Study

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Approval form

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Declaration

I certify that this thesis submitted for the degree of master, is the result of my ownresearch, except where otherwise acknowledged, and that this study (or any part of the same) has not been submitted for a higher degree to any other university or institution.

Signature:

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Date: 14 November 2022.

الإهداء

إلى من غرس في نفسي حب العلم والتعلم . . . إلى الذي بذل وأعطى وكان ظلي

حين تقسو الحياة . . .

" والدي الحنون "

إلى تلك العظيمة التي لم تتوانى للحظة ولم تشكو تعباً . . . إلى من كستني ثوب الإيمان

والتُقى وسيَرتني على الثابت من الخطى . . .

" أمي الغالية "

إلى ينبوع التفاؤل والأمل . . .

" أخوتي وأخواتي "

إلى من زرعوا التفاؤل في دربنا . . . إلى الأخوة اللذين جمعني بهم ميدان العمل

والدراسة .

إلى الوطن الغالي والشهداء الأبرار، الأسرى البواسل . . .

إلى كل يدٍ وقلبٍ ساهم معي في درب هذا الإنجاز .

Dedication

I dedicate this work to God Almighty and give me the strength to be able to do thiswork.

To my parents for their endless prayers and my family for their encouragement. To my lovely friends and previous doctor Jamal Qadumi patience and support. To my friends for supporting and encouragement.

To all martyrs and injuries in Palestine.

To every person help me to finish this work.

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First, I give all the glory to God, the source of my strength, for granting me both themental and physical endurance to complete this monumental task.

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Abstract:

Background: Clinical Neurological status assessment is an important element in making decision and predicting patient outcomes. Choose a proper tool was importantto evaluate a patient condition and early detection of patient's condition. Glasgow Coma scale and Full Outline Unresponsiveness scale are tools were used to evaluate level of consciousness.

Aim: the main aim of this study was comparing between Glasgow Coma scale and Full Outline Unresponsiveness scale with patients with neurological disorder in ICUs hospitals in west bank.

Methodology: The study design was quantitative, prospective observational cross- sectional study. All patients admitted to intensive care units and met inclusion criteriawere involved in this study 84. data was collected from Al-Najah national university, Al-Watani and Rafedia hospital by researcher and nurse's trainer who use data collection tool which contain demographic data, Glasgow Coma scale assessment, Full Outline Unresponsiveness scale assessment, predictive and actual outcome for each scale.

Result: 84 patients were assessed, 69% of the patients were male, the average length ofstay was 6.4 days. The mean score in Glasgow Coma scale was 11.23 on admission, 11.6 after 48 hour and 12.23 on discharge. While mean score in Full Outline Unresponsiveness score was 12.22 on admission, 12.38 after 48 hour and 12.47 on discharge.

Conclusion:

this study was revealed that the Glasgow Coma scale and Full Outline Unresponsiveness scales are significantly predictive patient outcomes in critically illpatients with neurological disorder. However, Full Outline Unresponsiveness scale was more accurate in evaluating patients' outcomes in intensive care unit.

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I. List of abbreviation

GCS	Glasgow coma scale.
FOUR	Full Outline of Unresponsiveness.
ICU	Intensive care unit.
CVA	Cardiovascular accident.
LOC	Level of consciousness.
SAH	Subarachnoid hemorrhage.
CNS	Central nervous system.
ATLS	Advance trauma life support
WFNS	World federation of neurological societies.
TBI	Traumatic brain injury.
APACHE	Acute physiology and chronic health evaluation.
NNUH	Najah national university hospital.
NNU	Najah national university.
AAUP	Arab American university Palestinian.
MOH	Palestinian Ministry of Health.
SPSS	Statistical Package for the Social Science

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Chapter One: Introduction

1.1 Background:

In critically ill patients, consciousness is often abnormal due to an acute primary brain injury or a secondary brain injury such as cardiopulmonary disease, shock and multiorgan failure (Wijdicks et al., 2015). For that, assessing patient's neurological status is an important indicator of patient warning conditions (Jalali & Rezaei, 2014).

A patient with neurological complications will stay in the hospitals and die twiceas likely as someone without neurological complications and the mortality rate is 55% versus 29% for non-complicated patients (Razvi & Bone, 2003).

Critically ill patients require neurological evaluation to determine their status, prognosis, and therapy. For accurate decision-making and prediction of patient outcomes, a suitable scale is required early in the patient evaluation process (Kwamboka, 2020).

Medical staff members face a number of ethical, social and economic challenges when managing sever brain injured patients due to lack of expertise. in order to care effectively for patient who, have disorders of consciousness, nurses must possess specific knowledge, competence and skills, as well as a customary planning and actions tailored to the specific needs of these non-communicative patients (Puggina et al.,2012).

Since the 1970s far too many prognostic models have been developed to predict patient outcome. Selecting and using a good diagnostic tool from the beginning is critical in

determining the primary diagnosis, medical care and patient outcome (Ramazani & Hosseini, 2019).

The Edinburgh-2 coma scale, Glasgow-Liege scale, Pittsburgh brain stem score, Comprehensive state of awareness scale, Reaction Level Scale, Innsbruck Coma Scale, Glasgow coma scale (GCS), and Full outline of unresponsive scale (FOUR) are mainly used in assessment of neurological status. Because of their scale are complicated and resemblance to the GCS, because health care personnel prefer to use the GCS, most of these scales are not in use. Such as, the Glasgow–Liege scale, the Pittsburgh brainstem score, and the FOUR score which examine brainstem functions and are more sensitive than the GCS. As significant as these scoring systems are in making therapeutic judgments and identifying clients with uncertain outcomes, they are also useful in identifying clients with unclear outcomes (Kwamboka, 2020).

The GCS was first created in 1974 to provide a more objective assessment of a person's neurological status. It is commonly used to predict an individual's outcome inintensive care (Ramazani & Hosseini, 2019).

The GCS has a high level of reliability which comprise:" eye, verbal and motor responses" (Wijdicks et al., 2015), however, many studies from 1990s have shown thatexperience with this scale is crucial, since novice observers can make significant errors in evaluation and revealed a gap between clinical practice and knowledge and suggested additional training for nurses. (Wijdicks et al., 1998; Kebapçı et al., 2020) Despite its extensive use, the GCS has limitations including its reliability and predictive validity (Ramazani & Hosseini,

2019). Moreover, it can't assess the verbal score of ventilated or aphasic patients. Also, it can't detect differences in a person's breathing pattern and brain stem reflexes (Jalali & Rezaei, 2014).

The FOUR was developed by Wijdicks et al. in 2005 as correction of GCS (Bayraktar et al., 2018) . This was done to improve the standard assessment of consciousness in patients who have been intubated or who have specific neurological impairments (Foo et al., 2019). On the other hand, the FOUR scale has been evolved to complete these foibles. It consists of four components that assess eye responses, motor responses, as well as brain stem reflexes and breathing patterns. Because of the neural details contained by FOUR scale, it is expected to have possible a stronger effect than GCS in predicting mortality in critical care units (Wijdicks et al., 2015). The FOUR score has a standardized scoring system that may be used to measure components of brainstem function in all patients, even those who are unable to speak verbally. (Almojuela et al.,2018). The FOUR score is an appropriate grading system for predicting outcome in severely ill elderly people (Ramazani & Hosseini, 2022).

In many patients with depressed level in consciousness, the FOUR score has been shown to be a reliable outcome predictor in the literature. It has been used to predict mortality and functional outcomes in a wide range of critically ill patients, with According to a study conducted by Abdallah et al. (2019) the FOUR and GCS scale are simple to use, as evidenced by the consistency of scores given to the same patient by two different practitioners. On the other hand, the FOUR score is more useful in evaluating patients who are unconscious and reliant on mechanical breathing because of the different *categories of*

scoring (Abdallah et al., 2019).

There has been a worldwide demand to find a more trustworthy instrument for assessing patients' neurological condition. In the past, most healthcare providers employed either the FOUR score or the GCS. The presence of the two scales used to assess patients appears to be adequate justification to compare their performance in prognosis and predicting outcomes for critically ill patients. The most researches conducted after 2005 have concluded that the FOUR scoring instrument is more reliableat predicting patient outcomes in ICU (Abdallah et al., 2019).

1.2 Problem statement

The GCS and FOUR scales are tow scales used to assess level of consciousnessin critical ill patients. GCS assesses patients' mental health status by measuring their reactivity in three categories: eye opening, muscular reaction, and verbal response (Alhassan et al., 2019). The FOUR score have four categories which consisted of: eye, motor, brain stem and respiration pattern assessment (Stead et al., 2008).

More than eighty countries utilize the Glasgow coma scale, and it is still thegold standard in evaluating the neurological condition of patients for continuing monitoring, prognosis, and clinical judgment (Alhassan et al., 2019).

According to researchers, the FOUR scores is more reliable and valid scale to evaluate level of consciousness with traumatic brain injury and cane be used instead of the GCS

(Kasem et al., 2019).

Access to trustworthy assessment scales is critical in current evidence-based medicine for forecasting mortality risk and the eventual outcome of critical management, allowing health care providers to assess the severity and prognosis of the patient's illness and make vital health care decisions appropriately (Bayraktar et al., 2019; Ali et al., 2019)

There has been an increase in knowledge of neurological evaluation. To make sure patient condition is stable after discharge, the neurological assessment is used to predict mortality and ensure that health care providers use appropriate management. Selecting the right scale at the beginning of patient assessment can facilitate management and decision making of the initial diagnosis, which helps treat patients early. The importance of this research is to discover the differences between GCS and FOUR scale in predicting patient's outcome. Furthermore, at the end of this study we will estimate which scale is more reliable in predicting patient outcomes. Accordingly, we will recommend continuous education and training program to all health care providers regarding how to use the FOUR scale since it has not been documented in Palestine and hospitals may implement this scale in ICUs. No previous studies were done in Palestine to address this comparison between FOUR and GCS in predictingmortality in patients with neurological disorders.

1.3 Significance of study.

Alteration and impairment on the level of consciousness is associated with bad outcomes, which increase in mortality and morbidity rate. About 5% of patient who arrived at

emergency department have an alteration in level of consciousness (Kasem etal., 2019).

To assess the disability and mortality of critically ill patients, assessment of the neurological condition should be in the shortest period by health care providers by usingthe appropriate scale (Ghelichkhani et., al, 2018).

FOUR scale was widespread increased in many countries and several departments in emergency, pediatric, neurology and medical ward compared with GCS. Some conditions including intubated patient, sedated and aphasic which impaired the verbal assessment makes the FOUR scale more applicable and reliable than GCS (Kasem et al., 2019).

Despite the reliability of FOUR scale in most studies which support its performance in assessing patients with neurological disorder more than GCS, still nohospital documented in Palestine using this scoring tool as an assessment of patient neurological status. For that, this study aimed to make comparison between the performance of FOUR scale and GCS to predict patient outcome in ICU. Furthermore, the study will assess the reliability of FOUR scale and its ability in predicting outcomes in patients with neurologic disorder in critical care unit.

1.4 Research Aim.

The main aim of this study is to compare between FOUR scale and GCS in predicting patient out come and mortality rate among patients with neurological disorder in ICUs.

1.5 Research objectives

1.5.1 General objectives of the study

This current study is aimed to compare the performance of GCS and FOUR score in predicting patient outcomes among patients with neurological disorders in critical care units. (death\ survive).

1.5.2. Secondary objectives

1. To determine the survival rate and morality rate among patients with neurological disorders in the critical care unit.
2. To estimate the accuracy of GCS and FOUR scales in the prediction of patient outcomes in ICU.

1.6 Research questions

1. What are the differences between GCS and FOUR in the prediction of patient outcome in ICU?
2. What are the outcomes (survive /died) predicted by FOUR scale and GCS?
3. What is actual outcome (survive /died) among patients with neurological disorder?
4. Which scale is more accurate to predict patient outcomes?

1.7 Hypothesis

There is no difference between the FOUR scale and Glasgow coma scale at predicting outcomesin patients with neurological disorder at ICU.

1.8 Conceptual definitions

Neurologic disorder: "is disorder that affect the brain and nerves over the human body and the spinal cord, structural, biochemical or electrical abnormalities in the brain" (neurology disorder, 2021).

Glasgow Coma Scale: a neurological scale consist 15 elements divided to 3 subscales: eyes response, verbal response, and motor response. It uses an initial assessment to determine level of consciousness and if patient in coma (Puggina et al.,2012).

Full Outline of Unresponsiveness Scale: a neurological scale consists of 16 items divided in 4 subscales: eyes response, motor response, brainstem reflexes, and respiratory patterns. Because of these neurological details it applicable in intubated and unconscious patient more than GCS in predicting patient outcome (Puggina et al., 2012).

Outcome: the consequence of admission critical care unit on day seven, which is the average length of stay of patients in the critical care unit. The patient outcome is either survive or death (Kwamboka, 2020).

Actual outcome: actual result of patient if alive or died on day of evaluation or on day

fourteen after admitted to ICU (Kwamboka, 2020).

Patient Mortality: a measure of the frequency of death in a defined population over a specific time period ((Jacob & Ganguli, 2016). During a study period a patient was admitted to the ICU and died during 1 month from admission (Kwamboka, 2020).

Patient survival: a patient's ability to remain alive on the day of the study's evaluation (Kwamboka, 2020)

1.9 Operational definitions

Neurologic disorder: in our study, neurological disorder was included hemorrhagic CVA (subarachnoid hemorrhage and intracerebral hemorrhage), ischemic CVA, atrioventricular malformation, cerebral aneurysm, traumatic brain injury headache, epidural and subdural hemorrhage.

Glasgow coma scale: is a tool that is used to objectively describe the level of consciousness impairment in a variety of medical and trauma cases. The scale evaluates patients' response in three components: eye-opening, motor, and verbal responses (Jain S,2021).

FOUR scale: is a clinical consciousness assessment measure that was developed to address the shortcomings of the widely used Glasgow Coma Scale (GCS). Which have 4 components: eye response, motor response, brain stem reflex and respiratory pattern (Jain S ,2021).

Outcome: The main outcomes are patient survival and patient mortality.

Actual outcome: actual result which gets during 1 month if patient was stillalive or died.

Patient mortality: during the study period, death of patient who admitted toICU during 1 month from admission.

Patient survival: during the study period, patient who admitted to ICU andsurvives during 1 month from admission.

Chapter Two: Literature review

2.1 Introduction

this chapter provided a summary of available research about neurological status assessment and scales that used in assessment. The literature study explain how the GCS and the FOUR score are used to assess neurological status. Also, it discuss pertinent previous studies from several nations in which researchers compared the ability of the GCS and the FOUR score to predict the outcome of patients with a neurological disorder.

2.2 Neurological Assessment

Changes in awareness are early observations that reveal information about a patient's neurological condition. In the ICU, consciousness assessment is the primary concern in patients with altered mental state, especially in cases of rapid hemodynamic changes (Abd Elrazek Baraka & Shalaby, 2021). In Pakistan, about 1.4 million of people are affected by neurological injuries (Yousef et al., 2021). So, clinical evaluation of neurological status is critical for decision-making, predicting outcomes, and communicating information among medical practitioners (Almojuela et al., 2019).

Furthermore, the LOC and responsiveness reflect a patient's condition. A diminished LOC is indicative of nervous system malfunction and is connected with higher morbidity and

death (Abd Elrazek Baraka & Shalaby, 2021).

One of the most typical results observed by physicians and nurses is a change inthe degree of consciousness, which is a condition of being less alert to and aware of environmental changes. Trauma; infections; neoplasms; metabolic reasons such as drugs, heavy metals, and carbon monoxide toxicity; extremes of body temperature, hypoxic encephalopathy; stroke; convulsions; subarachnoid hemorrhage (SAH); andalcohol toxicity are a few of the etiologies of altered consciousness (Kwamboka, 2020).

Patients with neurological or neurosurgical illnesses may show sudden changesin their LOC when arriving to the ICU. Hence, ICU nurses must be able to assess each patient's LOC effectively to allow the health care team to provide the necessary treatment and interventions, preventing permanent damage (Kebapçı et al., 2020).

Clinical neurological measures that have been initially created and are relatively easy to construct using physical examination indicators may help doctors diagnose, risk stratify, and evaluate the state of awareness in patients with central nervous system– related diseases and diminished LOC (Abdallah et al., 2019). The most fundamental and critical component of the neurological examination is the clinical assessment of consciousness. It is thought to be essential for eliminating errors and providing a more accurate assessment when evaluating patients in the ICU. Consciousness has two components: the LOC and the components of consciousness. The LOC is associated with alertness and awareness, whereas the components of consciousness are associated with the location, person, and time (Özçelik & Celik, 2021). In the ICU, scoring systems are frequently employed to

determine consciousness. These instruments have been created to help health care professionals to communicate with one another in a simple and consistent manner about a patient's general condition, neurological status, and cardiopulmonary status (Bayraktar et al., 2019).

In 1974, the GCS was created to evaluate neurological condition and predictionof outcome, and it is still widely used for patients admitted to the ICU (Ramazani & Hosseini, 2019). Unfortunately, the GCS has limitations, and thus researchers have sought a new scale for intubated patients and those with speech difficulty. The FOUR score measures how responsive a person is. Wijdicks et al. (2005) developed this scale to assess degree of awareness in non-trauma patients in the ICU, and its validity has been proven in similar study populations (Baratloo et al., 2017). The FOUR score is assimple to use as the GCS, which is the most generally used scale for evaluating consciousness (Bayraktar et al., 2019).

2.3 The GCS

The GCS was created in 1974 as a way to assess distinct groups of patients withchanged degrees of consciousness and to facilitate communication among health care professionals caring for these patients. It is the gold standard for determining the neurological condition of patients who have experienced a brain injury (Mushtaq et al., 2021). It was created to help practitioners communicate more effectively by offering a consistent language for

measuring the severity and duration of altered mental status and coma (Jalali & Rezaei, 2014). Use of the GCS became more common throughout the world beginning in the 1980s. Specifically, the Advanced Trauma and Life Support (ATLS) recommended using GCS to evaluate trauma victims and the World Federation of Neurological Societies (WFNS) recommended using the instrument to assess patientswith SAH (Jalali & Rezaei, 2014).

The GCS can be used without modification in children over the age of 5 years old. Children under 5 years of age and newborns lack the verbal skills required for the practitioner to use the scale to assess their orientation and the ability to obey the orders to evaluate their motor response. There have been various revisions to the Pediatric GCS since it was first described in Adelaide, but none of them has become widely accepted (Jain & Iverson, 2021).

The GCS is easy to use, and it has been validated and proven to be reliable.

Jennett and Teasdale (1974) first introduced the GCS instrument. The GCS assesses the function of the cerebral cortex and the upper brainstem, also known as the reticular activating system, through three components: eye opening, verbal response, and motor response. The eye-opening reaction assesses the brainstem's arousal mechanism, the verbal response assesses the cerebral cortex's integration with the brainstem, and the movement response assesses the integrity of the cerebral cortex and the spinal cord (Mushtaq et al., 2021).

Each of the three components of the GCS receives a different score (Silvitasari& Wahyuni, 2019). The eye reaction is scored between 1 and 4 points, the motor response is scored

between 1 and 6 points, and the verbal response is scored between 1and 5 points. The total score ranges from 3 to 15 points (Bayraktar et al., 2019). Eye opening is scored as follows: 4 when the patient's eyes open spontaneously, 3 in response to vocal stimuli utilizing basic instructions like "open your eyes," 2 in response to pain, and 1 if there is no response (Kasem et al., 2019). The verbal responseis scored as 5 if the patient knows who they are, where they are, and the date; 4 if the patient is confused; 3 if the patient replies with inappropriate words; 2 when the patient responds with meaningless or incomprehensible words; and 1 if the patient cannot respond (Kwamboka, 2020). Finally, the motor response is scored as 6 if the patient obeys commands to move; scored 5 when there is a voluntary movement in response toa painful stimuli and response to localized pain; scored 4 if the patient withdraws or flexes with pain; scored 3 if there is abnormal flexion with pain or decorticate posture (Kwamboka, 2020). Scored 2 if the patient's motor response consists of an extensor movement and a decelerating posture with their neck extended, their arms rigidly stretched near their elbows, their legs extended at knee level, and their feet in muscle contraction; and scored 1 if the patient exhibits no motor reaction despite the application of all previously mentioned stimuli (Kasem et al., 2019).

The patient's LOC is determined by the GCS total score: mild traumatic brain injury (13–15 points), moderate traumatic brain injury (9–12 points), and severe traumatic brain injury (3-8 points) (Kasprowicz et al., 2016). The GCS is related to thepatient outcome, it plays an important role in efficient, accurate assessment and is critical in choosing the appropriate therapeutic strategies and patient care (Kebapçı et al., 2020).

Despite its extensive use, the GCS has major limitations, including interrater reliability and

predictive validity variations (Jalali & Rezaei, 2014). Its use is restricted when verbal replies cannot be measured, particularly in intubated and aphasic patients; brainstem reflexes are not included in the scale; and the patient's breathing pattern is notconsidered. It is possible that early alterations in awareness linked to changes in breathing patterns and brainstem reflexes are undetected (Bayraktar et al., 2019).

2.4 The four score

Wijdicks et al. (2005) developed the FOUR score to address the GCS limitations(Almojuela et al., 2019), particularly in neurologically critically ill, sedated, aphasic, and intubated patients (Kwamboka, 2020) . Compared with the GCS, the FOUR score does not include the verbal response. Thus, the FOUR score is extremely effective for patients who are intubated, sedated, and aphasic. The FOUR score assesses critical brainstem reflexes and gives information about the severity of brainstem injury not obtained by the GCS (Furman et al., 2020). It has been proven in a variety of hospital settings including neurocritical care units, ICUs, emergency rooms, and neurosurgery (Ali et al., 2019).

The FOUR score differs from previous systems because it includes different classes for eyelid movement, motor exam, brainstem reflexes, and respiratory pattern. In this manner, the FOUR score offers a systematic scoring for components of brainstem function that can be evaluated in all patients, including those who are unableto fully communicate (Almojuela et al., 2019). Each section is graded from 0 to 4. The scores from each section are added together to produce the total score, which rangesfrom 0 to 16 (Bayraktar et al., 2019).

Eye response is scored as 4 when eyelids open and track on command. It is scored as 3 when the eyelids open but do not track a command. It is scored as 2 when the eyelids are closed and only open to loud noise. It is scored as 1 when the eyelids areclose but open in response to pain. Lastly, it is scored 0 when the eyelids stay closed with a stress stimulus (Kwamboka, 2020).

Motor response is scored from 0 to 4. The examination mainly focuses on the upper limbs because they are easy to observe. The score is 4 when the patient producesa sign similar to the peace sign when asked to do so. The score is 3 when the patient haslocalized pain. The score is 2 if the patient flexes in response to pain. The score is 1 when the patient extends in response to pain. Finally, the score is 0 when the patient cannot make any response with any stimulation or with myoclonus status epilepsy (Kasem et al., 2019; (Kwamboka, 2020).

The brainstem reflex depends on looking at the corneal and pupillary responses. The best way to assess corneal reflexes is to apply two or three drops of sterile saline tothe cornea from a distance of four to six inches away (this minimizes corneal trauma from repeated examinations). Another option is to use a sterile cotton swab. When bothof these reflexes are absent, only cough reflex by tracheal suctioning is examined (Kasem et al., 2019). If the pupils, corneal, and cough reflexes are present, the score is 4. When a pupil is wide and fixed, the score is 3. When the pupil reflex is missing but corneal reflexes are intact, the score is 2. If both pupillary and corneal reflexes are missing but a cough is present, the score is 1. When all reactions are missing, thescore is 0 (Kwamboka, 2020)

Respiratory pattern is scored as 4 when the patient has normal and regular breathing (Kwamboka, 2020) . A patient with Cheyne–Stokes respiration, characterized by gradually deeper and occasionally faster breathing followed by a steady reduction that causes a sudden loss of breathing known as apnea, receives a score of 3 (Kasem et al., 2019). The patient received a score of 2 if he/she is not intubated andhas irregular breathing (Kwamboka, 2020). A score of 1 is assigned to mechanically ventilated individuals who exhibit a pressure waveform of spontaneous breathing pattern or who trigger their ventilator. It is possible to recognize the patient-generated breaths on the ventilator by looking at the breathing patterns presented on the ventilator monitor. While the patient is being evaluated, the ventilator is not changed, although grading is ideally done with PaCO2 within normal ranges. The score is zero if a patient is breathing at the ventilator rate (Kasem et al., 2019).

In conditions including traumatic brain injury, postoperative examination of neurosurgical patients, and clinical monitoring of patients with acute ischemic stroke, the FOUR score has been suggested as a good instrument for clinical assessment and acredible alternative to the GCS. It has also been recommended as a supplemental examfor patients who have been resuscitated from drowning. In this patient population, the GCS and AVPU (alert/voice/pain/unresponsive) are suggested for the initial neurologicevaluation (Anestis et al., 2020).

Several lines of evidence suggest that the FOUR score has better reliability thanthe GCS. Nevertheless, many authors recommend using the GCS to assess patients because it is simple. In addition, numerous studies have reported no difference betweenthe GCS and the

FOUR score.

Between July 2016 and October 2017 in India, Ramazani and Hosseini (2022) conducted a study on 168 elderly patients admitted to the medical ICU to evaluate the ability of the FOUR score to predict mortality. All patients who participated in the study were assessed 24, 48, and 72 hours after admission, and then the outcome was evaluated (alive or dead). The authors found that the FOUR score is an appropriate grading system for predicting outcome in elderly patients. The FOUR score had a better detection outcome in 24 hours after admission compared with 48 and 72 hours after admission. However, the strongest measurement power occurred 48 hours after admission (Ramazani & Hosseini, 2022).

Furman et al. (2020) conducted a prospective observational cohort study from March 2012 to March 2013 in Slovenia to evaluate patients with traumatic brain injury prior to arrival at a hospital by using the GCS and the FOUR score. They compared the scales to determine which one is superior for predicting prognosis in patients with traumatic brain injury. The study enrolled 200 patients who had received treatment by health care providers before arriving at a hospital. Each patient was assessed with the GCS and the FOUR scale after contact in the event of an injury, during pre-hospital medical unit treatment, and after transfer by paramedic staff to a hospital. The researchers then evaluated the outcome after 24 hours, 1 month, and 3 months. Based on analyzing the area under the receiver operating characteristic curve (AUROC), a score of 12 for the FOUR 7scale and 8 for the GCS had the best predictive power for mortality. There was no difference between the instruments based on the Youden index (0.94 ± 0.02 for the FOUR scale and 0.93 ± 0.02 for the GCS). Moreover, there were no practical or functional differences between the GCS and the

FOUR score when predicting morality at 24 hours, 1 month, or 3 months following an accident. The FOUR score is more helpful for evaluating individuals who are unconscious and intubated because of the different assessment categories. The FOUR score has promising predictive potential and might be used routinely in the pre-hospital situation, particularly in intubated patients with brain injuries (Furman et al., 2020).

Researchers have also compared the GCS and the FOUR score in the ICU to evaluate interrater reliability and outcomes. The researchers enrolled 111 patients with impaired sensory perceptions, evaluating them on admission and then measuring outcomes at discharge. Their linear regression showed no significant relationship between each scales and no effect on length of stay in the ICU or patient stay while intubated. However, based on logistic regression, ICU outcomes were associated with both scales. The FOUR score's interrater reliability was not better than for the GCS, probably due to limited experience with the FOUR scale. The survival rate was statistically associated with both scales (Verma et al., 2020).

Another study aimed to compare between the GCS and the FOUR score to evaluate the LOC. The researchers designed and conducted a prospective observational study on 29 patients admitted to the ICU for more than 10 days between February and May 2019. There was a strong correlation between the GCS and the FOUR score ($P < 0.001$) regarding the conscious evaluation of patient in this study. Although the FOUR score could be used to evaluate the LOC instead of the GCS, the researches recommended repeating this study with larger and different samples (Doğu et al., 2020).

In Uganda, researchers compared the GCS and the FOUR score in patients with an altered LOC to predict mortality after 30 days. They enrolled 359 patients in their prospective observational study conducted between April 2017 and April 2018; these patients were transferred from the emergency department to the ICU. They collected data with an observational checklist then followed up 30 days after admission through phone or interview. They used the Youden index to measure maximum sensitivity and specificity to predict mortality. The best cut-off to predict mortality was 11 for the FOUR score and 8 for the GCS. Although both scales could predict mortality, the authors recommended using the FOUR score to guide the therapy of patients with a low LOC in Sub-Saharan Africa (Abdallah et al., 2019).

In another study, the authors estimated the probability of brain death in multipledisorders in Italian ICUs by using the GCS and the FOUR score. They conducted an observational study between May 2013 to August 2014 and enrolled 40 patient who were admitted to ICUs and assessed daily with both scales. The scales demonstrated 100% sensitivity to predict brain death but low specificity (FOUR score: 53.8%; GCS: 50.0%). These findings suggest that the FOUR score and the GCS could be utilized daily to predict brain death. The authors recommended using the FOUR score because itallows for easier assessment of brainstem reflexes (Zappa et al., 2020).

Ramazani and Hosseini (2019) aimed to compare the ability of the GCS and the FOUR score to predict the patient outcome 14 days after assessment. They conducted an observational prospective study with 300 patients who stayed for more than 48 hours in a medical ICU. They found a cut-off of 9 for the FOUR score and 7 for the GCS to predict

mortality. Although both instruments provided a good prediction, the FOUR score was more accurate than the GCS, and thus the authors recommended it for use in medical ICUs.

Foo et al. (2019) published a systematic review to evaluate the association between the FOUR score and the outcomes of patient with impaired LOC. They assessed 40 articles with different study designs. In patients with reduced consciousness, the FOUR score demonstrated a strong link to in-hospital mortality andpoor functional outcomes. There was not enough research to assess whether the ability differed between groups who suffer impaired in consciousness. They authors provided some speculation that brainstem reflexes and respiratory pattern assessments are lessimportant than visual and motor scores.

Several researchers suggest using the FOUR score instead of the GCS. Bayraktar et al. (2019) conducted a prospective study in Turkey (March–June 2017) to evaluate the reliability of the GCS and the FOUR score. They enrolled 79 patients who stayed in the ICU for at least 24 hours. A neurosurgeon and anesthesiologist evaluated patients on admission or after recovery from sedation and muscle relaxants. The FOUR score and the GCS did not differ significantly between the two evaluators. Patients with low FOUR and GCS scores had a greater rate of death than hospital mortality rate.

Because the FOUR score has a more comprehensive neurological examination than the GCS, the authors suggested that the FOUR score is more effective for patients who are unconscious or on mechanical respiration.

Ali et al. (2019) performed a prospective cohort study to evaluate patients with aneurysmal SAH with the GCS, the FOUR score, the Hunt and Hess (HH) Scale, and the WFNS Scale.

They aimed to determine which instrument best predicted mortality in patients with SAH. They considered 89 patients admitted to the ICU from November 2015 to November 2016 and evaluated them within the first 24 hours after admission to the neurological ICU and after 28 days. When evaluating the outcome after 28 days, the WFNS Scale and the FOUR score had the same specificity (86.26%), although it was lower than the HH Scale (92.5%). Unfortunately, both the HH Scale and the WFNS Scale had a lower sensitivity for predicting mortality (70.83%). All of the instruments had similar predictive power for mortality and outcomes on day 28, but when comparing between the GCS and the FOUR score, the latter was more accurate for predicting mortality (86.27% versus 72.55%), although they had similar sensitivity. In conclusion, the FOUR score provided a more detailed neurological evaluation and was more specific and sensitive than the GCS.

Braksick et al. (2018) applied the FOUR score to patients with intracranial hemorrhage to identify its accuracy to predict mortality at 1 month. They also compared the FOUR score with the GCS. They enrolled 274 patients with spontaneous hemorrhage in their retrospective study (data from 2009–2012). Both scales accurately predicted mortality after 1 month, but the FOUR scale may be a suitable alternative for GCS because it provides extra clinical information about the patient's condition (Braksick et al., 2018).

Temiz et al. (2018) conducted a prospective cross-sectional study in Turkey on 47 patients admitted to the neurological ICU after head trauma or cranial surgery. Upon admission, nurses in the neurological ICU evaluated each patient with the Acute Physiology and Chronic Health Evaluation (APACHE II). They also evaluated each patient with the GCS and the FOUR score twice daily until discharge from the ICU.

There was a high level of agreement among the nurses for both the GCS and the FOUR score. On the follow-up of patients managed in neurosurgical critical care units, the FOUR score was equally useful as the GCS, but the FOUR score was more appropriate for non-verbal patients and those with an abnormal breathing pattern.

Ghelichkhani et al. (2018) enrolled 90 patients with traumatic injury admitted to ICUs between February and September 2017 in Iran. They performed a diagnostic accuracy study to compare between the GCS and the FOUR score. The data were collected in two ICUs in different hospitals by two experienced nurses. The patients were evaluated with the GCS and the FOUR score when they were admitted to the ICU, and then 6, 12, and 24 hours later. When comparing the AUROC for the GCS and the FOUR score, there was no difference between the instruments for 6, 12 or 24 hours.

Thus, the GCS and the FOUR scale hade the same predictive value regarding the outcome of trauma patients. Both instruments demonstrated a high degree of accuracy in predicting the outcome at discharge (Ghelichkhani et al., 2018).

Khanal et al. (2016) carried out a prospective study on 97 patient who aged ≥ 16 years to compare between the ability of the GCS and the FOUR score to predict the outcome in neurological and neurosurgical ICUs. both scales had a cut-off of 6.5. In the analysis of the 37 patients who scored less than 6.5 on the GCS, 22 died, whereas of the 60 patients who scored higher than 6.5, 7 died. For the 37 patients with a FOUR score less than 6.5, 23 died, while for the 60 patients with a FOUR score above 6.5, 6 died.

The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of GCS were 75.86%, 77.94%, 59.46%, 88.33%, and 77.32%, respectively.

The same measures for the FOUR score were 79.31%, 79.41%, 62.16%, 90.00%, and 79.38%, respectively. Overall, the FOUR score was better than the GCS, and there was a good correlation between tow scales. Both instruments showed fair performance, but the FOUR score was better than the GCS in predicting the outcome of patients treated in neurological and neurosurgical ICUs.

In Poland, Kasprowicz et al. (2016) conducted a prospective cross-sectional study from 2010 to 2015 to compare between the GCS and the FOUR score with a multivariate predictive model. They evaluated patients with traumatic brain injury (n = 162). They used logistic regression to evaluate the probability of ICU mortality and poor outcome 3 months post-injury. Both instruments predicted a poor outcome 3 months after traumatic brain injury. Based on multivariate prediction modeling of patients with traumatic brain injury, the GCS and the FOUR score performed equally well.

Finally, the clinical neurological status assessment is an important element in decision-making and predicting patient outcomes. The GCS has been used to documentand formally assess neurological status. This scale has been lauded by health care workers for its simplicity and convenience of use. However, the GCS lacks accuracy in patients who cannot communicate effectively, such as those with severe neurological deficits or intubated patients. In addition, the GCS cannot clarify alterations in brainstem function and breathing patterns, which are important clinical factors that reflect the severity of impairment. These limitations warrant further research regardingits reliability in predicting outcomes including patient's mortality. Furthermore, the current recommendations are to use the FOUR score to predict patient outcome in the ICU. It is considered the best

instrument to evaluate the neurological status. In addition, it is more reliable than the GCS in predicting the outcome in critically ill patients. The aim of the current study was to compare the performance of GCS and FOUR score in predicting patient outcome among patients with neurological disorder in critical care units in Palestine. There have been no previous studies on this topic in Palestine.

Chapter Three: Methodology

This chapter describes the methodology that used to carry out this study, whichincludes the study design, site and setting, population, sample size and sampling method, eligibility criteria, data collection procedure, tools, validity and reliability, ethical consideration, fieldwork preparation, and data analysis.

3.1Study design

This quantitative prospective observational cross-sectional study compared the use of the GCS and the FOUR score in patients with neurological disorder admitted to ICUs in three hospitals in the West Bank between March and May 2022. All information was gathered by assessing patients according data sheet to determine prediction of mortality and actual outcomes in both scales.

3.2Study setting

This study was conducted in three hospitals that provide interventions for patients with neurological diseases., Al-Najah National University Hospital (NNUH), Rafedia Surgical Hospital, and Al-Watani Hospital in Nablus, these hospitals are a major referral hospital in the West Bank). NNUH is an academic non-profit medical institution that was established

in 2013 in cooperation with the Faculty of Medicine and Health Sciences of An-Najah National University (NNU) in Nablus. The hospital comprises 120 general admission beds and 18 adult ICU beds and patients come from all over Palestine, including the West Bank and the Gaza Strip. The hospital is considered the primary teaching hospital in Palestine: It provides clinical education and training to current and future health professionals. Al-Watani Hospital and Rafedia Surgical Hospital are located in Nablus and are run by the Ministry of health. These centers receive patients from the West Bank and provide education and training opportunities for students. Al-Watani Governmental Hospital was established in 1888 and specializes in internal medicine. It consists of 74 beds including 11 ICU and CCU beds. Rafedia Surgical Hospital was founded in 1976 and receives surgical cases. It contains 200 beds, including 13 ICU beds.

3.3 Data collection.

A structured observation checklist comprising four sections was developed based on previous studies to obtain information from each patient. **Section one** includeddemographic characteristics of patients, including age, gender, consciousness, medical diagnosis, length of stay in the ICU, educational level, occupation, diagnosis, past medical and surgical history, and whether the patient was sedated and/or intubated.

These data were collected from the patient, his/her family, or the medical files. **Sectiontwo** included the GCS score to evaluate the LOC of the patient upon admission, after 48hours, and upon discharge from the ICU. A GCS score of 13–15 was considered mild injury, a

score of 9–12 was considered moderate injury, and a score of 3–8 was considered severe injury (Jain et al., 2022). Each patient was followed up to evaluate after 1 month to determine whether he/she had died. **Section three** included the FOUR score to assess patients on admission, after 48 hours, and upon discharge. Each patient was evaluated after 1 month to determine if patient had died. **Section four** included the outcome after 1 month (dead or alive) whether alive or dead and the predicted outcome based on calculated cut-off scores of 6 for the GCS and 9 for the FOUR score (Kwamboka, 2020). The calculated cut-off FOUR score among ICU neurological patients was 8, with a sensitivity of 0.94 and a specificity of 0.71. The calculated cut-offGCS score was 8.5, with a sensitivity of 0.94 and specificity of 0.76.

3.4 Data collection procedures

The research objective and its significance were explained to patients admitted tothe ICUs with neurological injury and/or their families. Each patient signed an informed consent; if the patient was unconscious, his/her family provided consent. Each patient was assessed using the GCS and the FOUR score by the researcher and tow volunteers who had received training in another hospital by neurosurgeons. Each patient was assessed upon admission, after 24 hours, and upon discharge from the ICU. Each evaluation took 15–20 minutes. After 1 month, each participant was contacted by eitherphone call or interview to determine patient's outcome. The data were collected between March 20 and June 1, 2022.

3.5 Study population

This study included patients in the cardiac, medical, surgical, and neurological ICUs in three main hospitals in the West Bank. The target population comprises adult patients over 18 years old who had been admitted to these departments for at least 48 hours to treat neurological disorders. Based on hospital records, each institution treats 10–15 patients with neurological disorders each month.

3.6 Sample size calculation

The sample size calculation was guided by Fisher et al. method found in Mugenda and Mugenda (2004), a sample was equal 384 when population more than 10,000 then adjustment sample related Yamane formula (1967).

The sample size calculation was guided by Fisher et al. (2004) method found in Mugenda and Mugenda (2004), calculated as follows:

$$n = \frac{Z^2 pq}{d^2}$$

Where:

n = desired sample size (where population >10,000).

Z = value representing area covering 95% of the population taken as 1.96.

p = since the level of validity of Glasgow coma scale and FOUR is not known,we will use 50% (0.5)

q= 0.5 (1-0.5).

d = margin of error of 5%.

$$n=\frac{(1.96)2\times0.5\times0.5}{(0.05)^2}=\frac{3.8416\times0.5\times0.5}{0.0025}=\frac{0.9604}{0.002}=384 \text{ Samples}$$

Since the average admission number of patients in ICU with neurological disorder, the Palestinian hospitals less than ten thousand (10,000). Yamane formula(1967) was used in sample adjustment as

$$nf: \frac{n}{(1+\frac{n}{N})}$$

Defined as:

nf = the sample size for population <10,000 n= sample size when population is >10,000

N= estimated study population, in this study taken as 100 (Data from electronic system Departments in each hospital).

$$nf = \frac{n}{(1+\frac{n}{N})}$$

$$= \frac{384}{(1+\frac{384}{100}} = \textbf{80 sample .}$$

3.7 Sampling Technique

The sample size was calculated *a priori* by using openEPI and guided by formulae reported by Fisher et al (2004) and Yamane (1967). Based on the calculation, 80 patients would be required. However, we aimed to enroll 84 p participants in case of dropout. The sample was distributed as follows: 27 patients from NNUH (32.1%), 29 patients from Rafedia Surgical Hospital (34.5%), and 28 patients from Al-Watani Governmental Hospital (33.3%).

3.8 inclusion and exclusion criteria

To qualify for the study, the admitted patients had to satisfy the following

Inclusion Criteria:

1. Aged ≥ 18 years;
2. Stayed for at least 48 hours in the ICU.
3. Had a neurological disorder, including atrioventricular malformation, aneurysm, traumatic brain injury, headache, ischemic cardiovascular accident (CVA), hemorrhagic CVA, or epidural or subdural hemorrhage.

The exclusion criteria were:

1. Medically paralyzed/deeply sedated or had received a neuromuscular block;
2. Hearing or visual impairment;
3. Degenerative brain disease or mental retardation;

4. Malignant and fatal disease, cervical spinal cord injury, or musculoskeletalparalysis.

3.9Variables

3.9.1 Dependent variables

1. Mortality rate.
2. Predicted outcomes.
3. Outcomes (survival or death)

3.9.2 Independent variables:

1. Patient characteristics.
2. GCS and FOUR scales.

3.10 Validity

After constructing the data collection sheet, it was reviewed by a panel of experts: an anesthesiologist in the ICU, a neurosurgeon, two ICU nurses with expertise dealing with patients with neurological disorders, and academic doctors. The providedfeedback on how to improve the form.

3.11 Reliability

The reliability of the GCS and the FOUR score has been checked in previous studies

(Amirtharaj et al., 2022; Haldar et al., 2020; Yan et al., 2022). Data were cleaned to control for errors or missing data. Chronbach's alpha was 0.920 (conductedon 9 items).

3.12 Ethical Considerations

Ethical reviewing and approval for this study was taken by the Health Research Ethics Committee of the AAUP, from the Palestinian MOH and of the hospitals administrators where the study conducted. Also, Helsinki committee for ethical approval has decided to approve the research study, by Palestinian health research council.

A consent form w obtained from participant or family if unconscious and had a right to refuse in participation or withdrawn from study. In addition, all the participants in the study were named by code to keep anonymity and confidentiality forall participants.

3.13Analysis:

In this study, statistical analysis of data was done by using the SPSS version 24.

SPSS is a software package will be used for conducting statistical analysis, manipulating data, generating tables and graphs by using descriptive statistical analysis such as frequency tables, graphically illustrated by using bar charts. means and standarddeviations was used to summarize data. We used a statistical significance being set at $p < 0.05$ to determine relationship between demographic characteristic and mortality. furthermore, qi-squared test conducted to determine the association between the predicted GCS and FOUR score in relation to patient actual outcome at the end of evaluation. Binary logistic

regression for relationship between predicted and actual outcomes. area under the curve to predicting ICU neurological patients mortality, we used cross tabulation for actual and predicted outcome. we calculated a cut point for each scales then used sensitivity and specificity to determine reliability and accuracy ineach scale.

Chapter Four: Results

Introduction: The present thesis aims to assess and compare the ability of GCS with FOUR score in predicting neurological patient outcomes in Intensive Care Unit (ICU) of three referral hospitals (two governmental and one teaching hospitals). The sensitivity and specificity of both scales were calculated.

Demographic characteristics of the neurological ICU participants

According to the characteristics of the patients participating in the study, theresults showed that their percentage is equal in relation to the hospital, while the majority of them were unemployed (40.5%) males (69.0%) who obtained only a school education (42.9%), mean age 48. See table 1.

Table 1: Demographic characteristics of the ICU neurological patients

		Frequency	**Percent**
Hospital	NNUH	27	32.1
	Rafedia	29	34.5
	Alwatani	28	33.3
Department	SICU	26	31.0
	ICU	58	69.0
Gender	Female	26	31.0
	Male	58	69.0
Area	Gaza	6	7.1
	Salfeet	3	3.6
	Ramallah	8	9.5

	Qalqelia	5	6.0
	Nablus	41	48.8
	Jenin	12	14.3
	Hebron	2	2.4
	Bethlahem	1	1.2
	Tulkarm	4	4.8
	Tubas	2	2.4
Occupation	Format employment	6	7.1
	Self -employment	20	23.8
	Unemployed	34	40.5
	Student	9	10.7
	Other	15	17.9
Educational level	Illiterate	24	28.6
	School	36	42.9
	University	24	28.6
Age (years)	48.17 (20.59)	18.00	87.00
	≤18	4	4.8
	19-30	21	25.0

	31-50	16	19.0
	>50	43	51.2

ICU neurological patients' medical characteristics:

Hemorrhagic stroke was the most common among the participating patients (46.4%), followed by ischemic stroke (19%) . medical history was more common than surgical history (60.7% & 33.3% respectively). As for sedation and intubation, 8.3% of patients were sedated while 25% of the patients were intubated. See table 2.

Table 2: ICU neurological patients' medical characteristics.

		Frequency	**Percent**
Hemorrhagic CVA	No	45	53.6
	Yes	39	46.4
Ischemic CVA	No	68	81.0
	Yes	16	19.0
Epidural Hemorrhage	No	77	91.7
	Yes	7	8.3
Subdural Hemorrhage	No	78	92.9
	Yes	6	7.1

Other brain disorder	No	61	72.6
	Yes	23	27.4
Past medical history	No	33	39.3
	Yes	51	60.7
Past surgical history	No	56	66.7
	Yes	28	33.3
Patient sedated	No	77	91.7
	Yes	7	8.3
Patient intubated	No	63	75.0
	Yes	21	25.0

Level of consciousness among ICU neurological patients' using GCS scales:

By following up the level of consciousness among patients using the Glasgow Coma Scale, the results showed that the average level of consciousness among the patients participating in the study on admission to the hospital was 11.23 out of 15, while increased to 12.23 out of 15 at the end point of follow-up. For more details see table 3 and figure 1 and 2.

Table 3: Level of consciousness among ICU neurological patients' using GCS scales.

		On Admission		after 48 hours		On discharge	
		n	%	n	%	n	%
Eye opening	No response	4	4.8	8	9.5	16	19.0
	To pain	17	20.2	14	16.7	1	1.2
	To speech	21	25.0	6	7.1	1	1.2
	Spontaneous	42	50.0	56	66.7	66	78.7
Motor response	No response	3	3.6	7	8.3	15	17.9
	Extension to pain	8	9.5	6	7.1	2	2.4
	Flexion with pain	6	7.1	7	8.3	0	0
	Withdrawal with pain	7	8.3	4	4.8	2	2.4
	Localizing to pain	27	32.1	14	16.7	7	8.3
	Obeying command	33	39.3	46	54.8	58	69.0
Verbal response	No response	15	17.9	24	28.6	19	22.6
	Inappropriate sound	11	13.1	4	4.8	0	0
	Inappropriate words	13	15.5	2	2.4	1	1.2
	Confused	25	29.8	16	19.0	12	14.3

	Oriented	20	23.8	38	45.2	52	61.9
GCS mean (SD)		**11.23 (3.48)**		**11.60 (4.30)**		**12.23 (4.70)**	

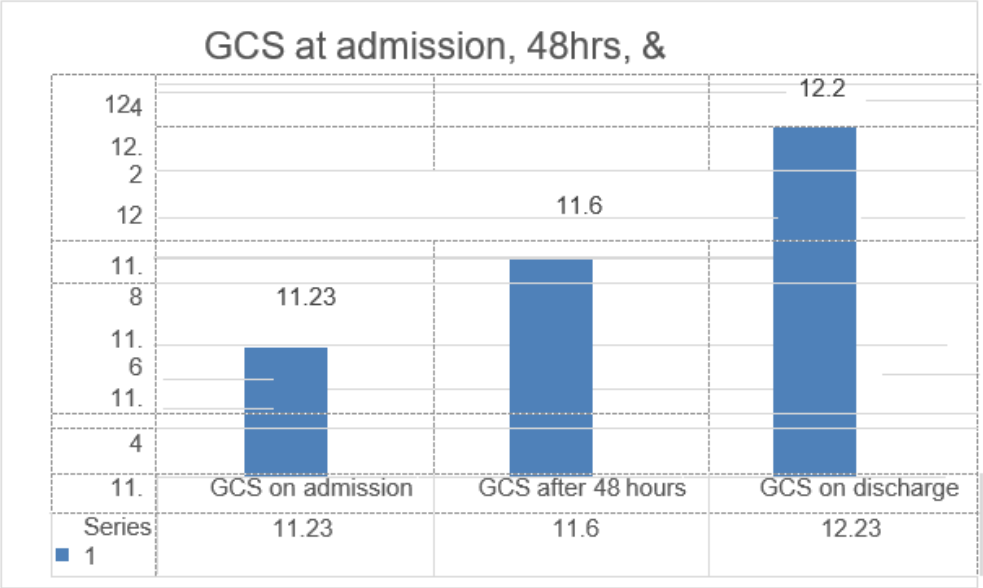

Figure 1: Level of consciousness using GCS scales at admission, 48 hours, & discharge among neurological ICU participants without excluded patients who death .

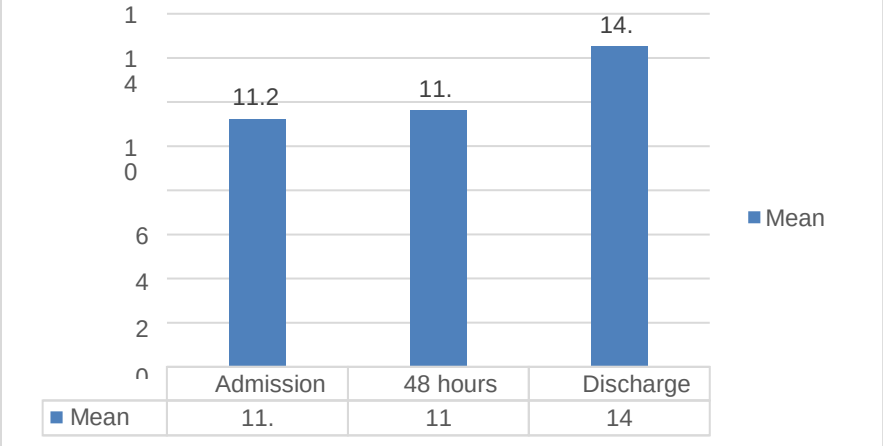

Figure 2: Level of consciousness using GCS scales at admission, 48 hours, & discharge

among neurological ICU participants with excluded patient who died

Level of consciousness among ICU neurological patients' using FOURscales.

By following up the level of consciousness among patients using the FOUR scales, the results showed that the average level of consciousness among the patients participating in the study on admission to the hospital was 12.22 out of 16, then increased to 12.47 out of 16 at the end point of follow-up. For more details see table 4and figure 3 and 4 .

Table 4: Level of consciousness using FOUR scales among ICUneurological patients.

		Admission		**on 48 hours**		**Discharge**	
		n	**%**	**n**	**%**	**n**	**%**
Eye response	Eyelids remain closed with pain	4	4.8	8	9.5	16	19.0
	Eyelids closed-but open to pain	15	17.9	14	16.7	1	1.2
	Eyelids closed-but open to aloud voice	13	15.5	5	6.0	1	1.2
	Eyelids opening but not tracking	9	10.7	3	3.6	1	1.2
	Eyelids open or opened, tracking or blinking to command	43	51.2	54	64.3	65	77.4
Motor response	No response to pain or generalized myoclounus status	3	3.6	7	8.3	15	17.9
	Extension response to pain	8	9.5	6	7.1	2	2.4
	Flexion response to pain	12	14.3	11	13.1	1	1.2
	Localizing to pain	25	29.8	14	16.7	9	10.7
	Thumbs up, fist or peace sign	36	42.9	46	54.8	57	67.9
Brainstem	Absent pupil, corneal and cough	1	1.2	2	2.4	15	17.9

reflexes	reflex						
	Pupil and corneal reflexes absent	2	2.4	5	6.0	0	0
	Pupil or corneal reflexes absent	8	9.5	4	4.8	0	0
	One pupil wide and fixed	9	10.7	9	10.7	2	2.4
	Pupil and corneal reflexes present	64	76.2	64	76.2	67	79.8
Respiration	Breath at ventilator rate or apnea	0	0	4	4.8	15	17.9
	Breathe above ventilator rate.	17	20.2	20	23.8	3	3.6
	Not intubated irregular breathing	13	15.5	7	8.3	4	4.8
	Not intubated, cheyne- stocksbreathing	15	17.9	7	8.3	11	13.1
	Not intubated , regular breathing .	39	46.4	46	54.8	51	60.7
FOUR mean (SD)		**2.22 (4.10)**		**12.38(4.77)**		**12.47 (6.07)**	

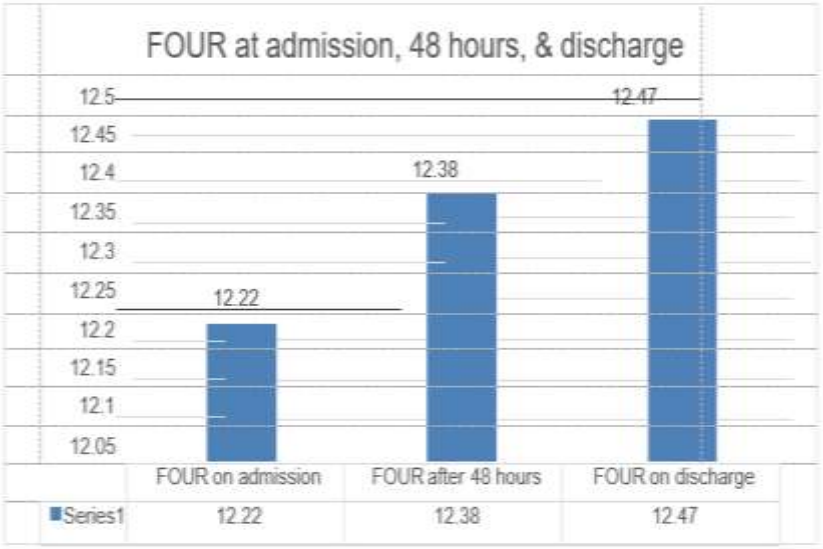

Figure 3: Level of consciousness using FOUR score at admission, 48 hours, & discharge among neurological ICU participants without excluded patients who died.

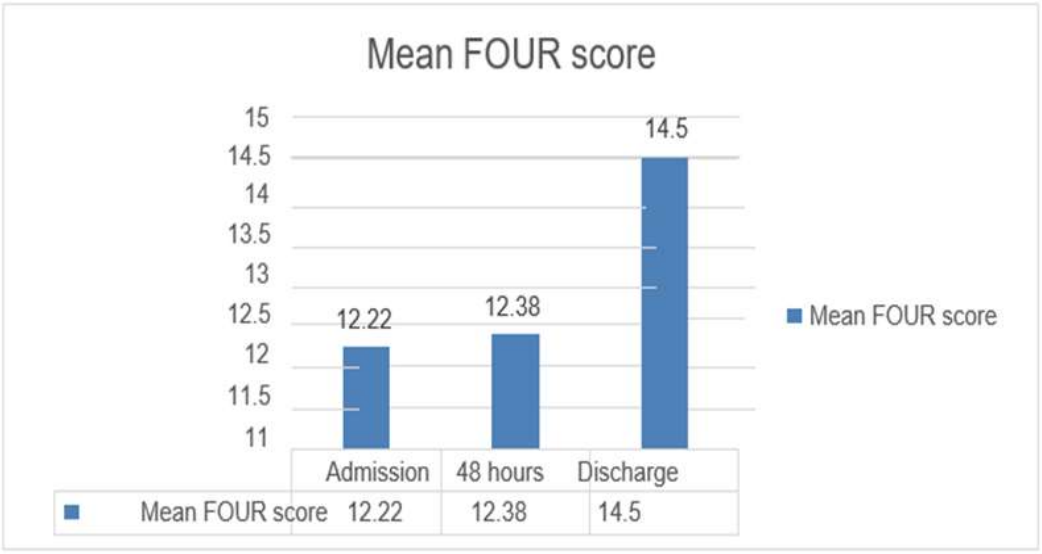

Figure 4: Level of consciousness using FOUR score at admission, 48 hours, & discharge among neurological ICU participants with exclude patients who died.

Level of consciousness using GCS and FOUR scales among ICU neurological patients:

shows the classification of patients' consciousness level using the GCS and FOUR Skill tools. By looking at the table, it appears that the percentage of patients with a score above 12 out of 15 in GCS, which expresses a good outcome. On the other hand, patients with a score above 12 out of 16 in FOUR scale which expresses a good outcome, it was 60.7% at the time of admission. see table 5 for more details.

Table 5: Level of consciousness using GCS and FOUR scales among ICU neurologicalpatients

		Admission	> 48 hours	Discharge
Scale	**Measurement Score**	**n(%)**	**n(%)**	**n(%)**
GCS	< 6	7(8.3)	12(14.3)	16(19.0)
	6-12	43(51.2)	20(23.8)	3(3.6)
	>12	34(40.5)	52(61.9)	65(77.4)
FOUR	< 9	16(19.0)	21(25.0)	17(20.2)
	9-12	17(20.2)	7(8.3)	1(1.2)
	>12	51(60.7)	56(66.7)	66 (78.6)

Actual outcomes at the end of evaluation of ICU neurological patients:

The results showed that 20.2% of the patients participating in the study died during their follow-up, while the average hospital stay was 6.42 days .

Table 6: Actual outcomes at the end of evaluation of ICU neurological patients .

			Frequency	Percent
Patients' outcome	**Mortality**	Alive	67	79.8
		Death	17	20.2
	Length of stay in ICU	6.42 (5.74)	2.00	37.00
	Length of stay in ICU (day)	2	10	11.9
		3-14	69	82.1
		>14	5	6.0

Neurological participants' patient demographic characteristics and outcome at the end of evaluation.

Regarding the relationship of the demographic characteristics of the patients participating in the study with the end point (mortality) . the results showed the education level of the patients participating in the study had a statistically significant relationship with death. where the p value was 0.039, where the mortality rate was lowest among patients with a university degree (4.2%) as shown in table 7.

Table 7: Association between ICU neurological patients demographic characteristics and outcome at the end of evaluation.

		Patient outcome					
		Alive	**Death**				
		n(%)	**n(%)**	**Total**	**χ^2**	**df**	***p*-value**
Age (years)	≤18	3(75.0)	1(25.0)	4	.911	3	.823
	19-30	17(81.0)	4(19.0)	21			
	31-50	14(87.5)	2(12.5)	16			
	>50	33(76.7)	10(23.3)	43			
Gender	Female	20(76.9)	6(23.1)	26	.188	1	.665
	Male	47(81.0)	11(19.0)	58			
Area	Gaza	5(83.3)	1(16.7)	6	10.316	9	.326
	Salfeet	3(100.0)	0(0.0)	3			
	Ramallah	8(100.0)	0(0.0)	8			
	Qalqelia	5(100.0)	0(0.0)	5			
	Nablus	31(75.6)	10(24.4)	41			
	Jenin	9(75.0)	3(25.0)	12			
	Hebron	2(100.0)	0(0.0)	2			
	Bethlahem	0(0.0)	1(100.0)	1			
	Tulkarm	3(75.0)	1(25.0)	4			

	Tubas	1(50.0)	1(50.0)	2			
Occupation	Format employment	6(100.0)	0(0.0)	6	7.238	4	.124
	Self-employment	17(85.0)	3(15.0)	20			
	Unemployed	23(67.6)	11(32.4)	34			
	Student	9(100.0)	0(0.0)	9			
	Other	12(80.0)	3(20.0)	15			
Educational level	Illiterate	16(66.7)	8(33.3)	24	6.478	2	.039
	School	28(77.8)	8(22.2)	36			
	University	23(95.8)	1(4.2)	24			

χ2:chi-square

ICU neurological patients' medical characteristics and outcome at the end ofevaluation:

Regarding the relationship of the medical history of the patients participating inthe study with mortality. the results showed that hemorrhagic CVA, ischemic CVA, sedated and intubated patients had statistically significant relationship.

Table 8: Association between ICU neurological patients' medical characteristics and outcome at the end of evaluation.

		Patient outcome					
		Alive	**Death**				
		n(%)	**n(%)**	**Total**	**χ^2**	**df**	***p*-value**
Hemorrhagic CVA	No	45(100.0)	0(0.0)	45	24.592	1	.000
	Yes	22(56.4)	17(43.6)	39			
Ischemic CVA	No	51(75.0)	17(25.0)	68	5.015	1	.025
	Yes	16(100.0)	0(0.0)	16			
Epidural Hemorrhage	No	60(77.9)	17(22.1)	77	1.938	1	.164
	Yes	7(100.0)	0(0.0)	7			
Subdural Hemorrhage	No	62(79.5)	16(20.5)	78	.051	1	.821
	Yes	5(83.3)	1(16.7)	6			
Other brain disorder	No	46(75.4)	15(24.6)	61	2.614	1	.106
	Yes	21(91.3)	2(8.7)	23			
Past medical history	No	29(87.9)	4(12.1)	33	2.218	1	.136
	Yes	38(74.5)	13(25.5)	51			

Past surgical history	No	48(85.7)	8(14.3)	56	3.687	1	.055
	Yes	19(67.9)	9(32.1)	28			
Patient sedated	No	65(84.4)	12(15.6)	77	12.397	1	.000
	Yes	2(28.6)	5(71.4)	7			
Patient intubated	No	61(96.8)	2(3.2)	63	45.454	1	.000
	Yes	6(28.6)	15(71.4)	21			

χ^2:chi-square

Area under the curve of FOUR, and GCS in predicting ICU neurological patients' mortality:

The areas under receiver operating curves discrimination (area under the ROCcurve; 95% CI): GCS (.926; CI= .871 - .982), and FOUR (.941; CI= .892 - .991) in prediction of mortality. FOUR showed the best highest discriminative power, followed by GCS in prediction of hospital mortality outcomes as seen in Figure 5 and Table 9.

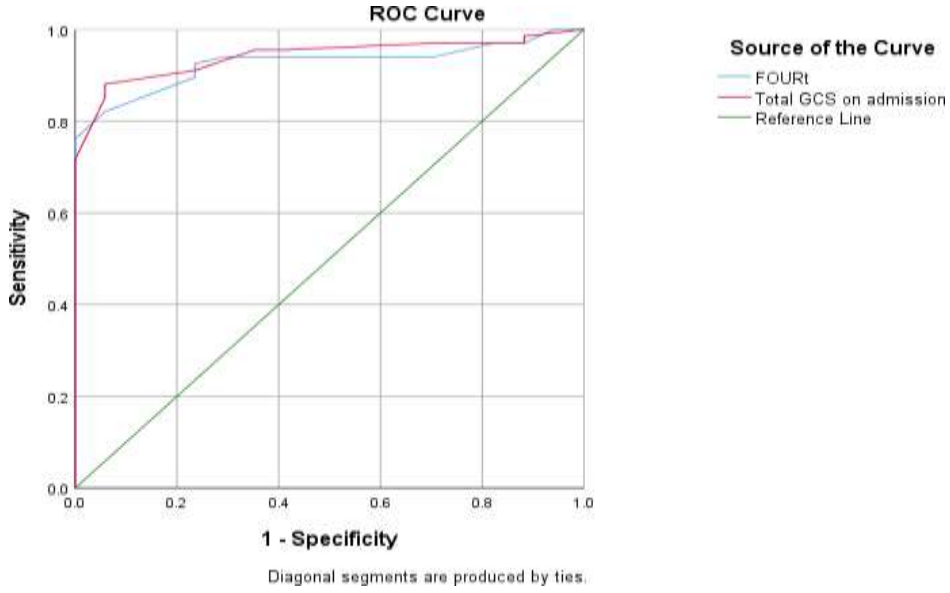

Figure 5: Area under the curve of FOUR, and GCS in predicting ICU neurological patients' mortality.

Table 9: Area under the curve of FOUR, and GCS in predicting ICU neurological patients' mortality

Test Result Variable(s)	Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
FOUR	.926	.028	.000	.871	.982
GCS	.941	.025	.000	.892	.991

GCS & FOUR scales' sensitivity analysis among ICU neurologicalpatients:

To assess the ability of the scales (GCS & FOUR) in predicting mortality among ICU patients, sensitivity analysis was conducted as shown in Table 10 . The results show that both scales had a high sensitivity on the admission and equal on discharge to predict the mortality. FOUR scale has a high specificity in three phases, and this mean FOUR scale more accurate than GCS in predict outcomes . As Table 10 showed.

Table 10: GCS and FOUR scales for prediction of ICU neurological patients' mortality.

Scale	Cut-off	Period	Sensitivity	Specificity	PPV	NPV
GCS	6.0	At admission	97.4%	29.4%	84.4%	71.4%
		After 48 hours	97.0%	58.8%	90.3%	83.3%
		Discharge	100%	94.1%	98.5%	100%
FOUR	9.0	At admission	94.0%	70.6%	92.6%	75.0%
		After 48 hours	89.6%	82.4%	95.2%	66.7%
		Discharge	100%	100%	100%	100%

PPV – Positive predictive value, **NPV** – Negative predictive value.

Actual and predicted outcome among ICU neurological patients:

Table 11 show that there was a statistically significant correlation between the actual outcomes with the predicted outcome of GCS ($\chi 2=12.397$, p <0.001) and predicted outcome of four ($\chi 2=36.718$, p <0.001).

Table 11: Cross tabulation for actual and predicted outcome among ICU neurologicalpatients

Actual Patient outcome							
		Alive	**Death**	**Total**	χ^2	**df**	***p*-value**
Predict outcome by **GCS**	**Alive**	65(84.4%)	12(15.6%)	77	12.397	1	.000
	Death	2(28.6%)	5(71.4%)	7			
Predict outcome by **FOUR**	**Alive**	63(92.6%)	5(7.4%)	68	36.718	1	.000

ICU neurological patients Survival Analysis Curve:

The results as shown in Figure 6 shows that, at admission (Zero days) all patients were alive, after 48 hours the results show that 100% of the patients were alive. At 10 days, the probability of survival was 60%. The analysis also shows that by the evaluation on day 13 approximately 42% of the respondents were alive.

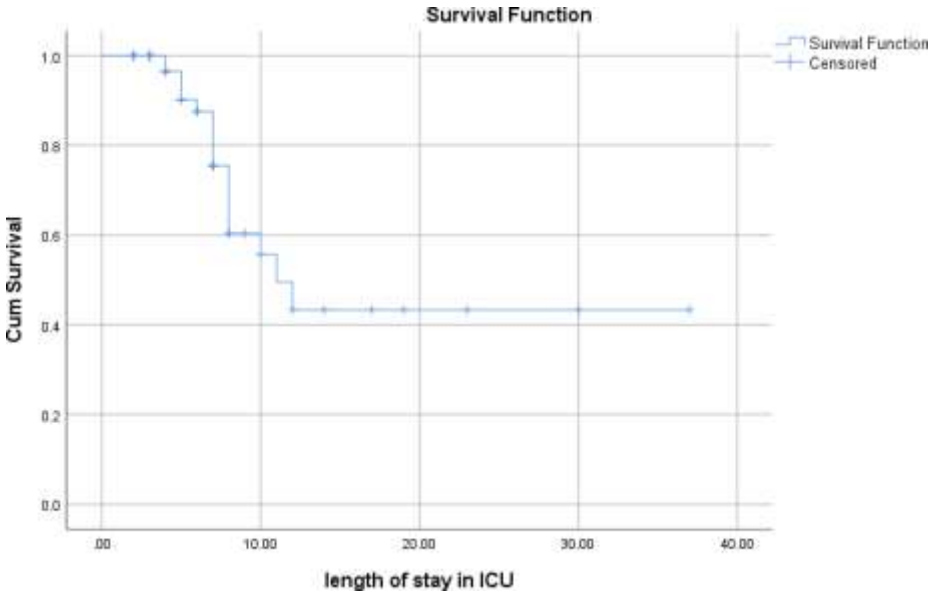

Figure 6: Survival analysis curve of neurological ICU studyparticipants

The relationship between predicted GCS at admission and actual ICU neurological patients' mortality:

A binary logistic regression was performed to establish the relationship betweenpredicted GCS and actual patient outcome on the probability of mortality as an end point. The logistic regression model was statistically significant, χ^2 (1) = 8.501, p = .004. The model explained 17.0% (R^2) of the variance in mortality and correctlyclassified 29.0% of cases.

GCS score at admission was found to be a significant predictor of actual patientmortality (p = .004, OR= 13.54, 95% CI [2.349-78.055]. The findings show that GCS score at admission was 13.8 times more likely to predict an accurate actual mortality atthe end of evaluation.

Table 12: binary logistic regression for the relationship between predicted GCS at admission and actual ICU neurological patients' mortality

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Predict outcome by GCS admission	2.606	.894	8.501	1	.004	13.542	2.349	78.055
Constant	-4.295	1.046	16.851	1	.000	.014		

Variable(s) entered on step 1: Predict outcome by GCS admission.

The relationship between predicted FOUR score at admission and actual ICU neurological patients' outcome:

A binary logistic regression was performed to establish the relationship betweenpredicted FOUR score and actual patient outcome on the probability of mortality as an end point. The logistic regression model was statistically significant, $\chi 2$ (1) = 24.023, p < .001. The model explained 48.5 % (R2) of the variance in mortality and correctlyclassified 70.6 % of cases.

FOUR score at admission was found to be a significant predictor of actual patient mortality (p < .001, OR= 37.80, 95% CI [8.845-161.549]. The findings show that FOUR score at admission was 37.8 times more likely to predict an accurate actualmortality at the

end of evaluation.

Table 13: binary logistic regression for the relationship between predicted FOUR score atadmission and actual ICU neurological patients' mortality

	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95% C.I.for EXP(B)**	
							Lower	Upper
Predict outcome by FOUR admissions	3.632	.741	24.023	1	.000	37.800	8.845	161.549
Constant	-6.166	1.094	31.767	1	.000	.002		

Variable(s) entered on step 1: predict outcome by FOUR admissions.

The calculated cut point of FOUR score among ICU neurological patients was 8out of 16 with a sensitivity of .94 and specificity of .71, while, the calculated cut point of GCS among ICU neurological patients' (study participants) was 8.5 out of 15 with asensitivity of .94 and specificity of .76

Chapter Five: Discussion

Within this chapter, the study discusses the finding relating to aim, compare the performance of the GCS and the FOUR score to predict the patient outcome, mortality in ICUs in the West Bank. Also, compare the findings of this study to otherstudies carried out elsewhere to identify the similarity and differences associated withthe neurological scales.

5.2 Demographic characteristics of the participants

More than half of the participants were male, this finding consistent with previous studies (Kasem et al., 2019; Özçelik & Celik, 2021). The high rate of smoking among Palestinian males and their greater intake of fatty food may underlie the greater incidence of stroke among men (Ali et al., 2019). In addition, men are more likely to be involved in traffic accidents. Consistently, Wilberforce et al. (2015) found in increase in men involved in traffic accidents in Kenya. The effects of estrogen have been shown toprotect women from stroke (Ali et al., 2019). Also, Men were more affected by genetics than females (Ali et al., 2019). The mean age of the participants in this study was 48.17 ± 20.95 years, which is similar to a study in Slovenia (47.9 ± 21.1 years) (Furman et al., 2020).

The educational level showed a significant correlation with mortality. Most of the population had a secondary school education, which is consistent with the study by Kwamboka (2020). Luy et al. (2019) found a relationship between mortality and health

disorders and the educational level: People with more education used their knowledge to avoid disease. Moreover, socio-psychological and emotional support that can be promote long term health (Luy et al., 2019).

Hemorrhagic stroke was the most common neurological disorder among the participants (46.4%), followed by ischemic stroke (19%). These percentages are different from those reported by Erkabu et al. (2018): 40.6% for hemorrhagic stroke and 59.4% for ischemic stroke. Note that the higher percentage of hemorrhagic stroke is likely because two hospitals in our study receive patients with hemorrhagic CVA. In addition, patients with ischemic CVA stayed in the ICU not more than 48 hours. Most patients with ischemic CVA stay in the ICU for less than 24 hours.

5.3Medical characteristics of the participants

In this study, 8.3% of the patients had received minimal sedation and 29% had been intubated. According to Aliakbar et al. (2016), sedation in trauma patients decreases the GCS and the FOUR score, with the mean GCS score being higher than the mean FOUR score. In addition, when determining the LOC in sedated patients, the FOUR score performs better than the GCS (Aliakbar et al., 2016). In this study, completely sedated patients were excluded in study.

Beyond hemorrhagic and ischemic CVA, the patients also presented epidural hemorrhage (8.3%), subdural hemorrhage (7.1%), or other brain disorders (27.4%). According to Oduor

(2015), falls from 3 m and motorcycle and auto accidents are the most frequent causes of trauma and hemorrhage. In the present study, hemorrhagic CVA was more common than ischemic CVA because two of the considered hospitals (NNUH and Rafedia Surgical Hospital) take hemorrhagic CVA cases, while only Al- Watani Governmental Hospital takes ischemic CVA cases. The mean ± standard deviation (SD) length of stay in the present study was 6.42 ± 5.74 days, which is similarto a study in Turkey (6.36 ± 10.15 days; Özçelik & Celik, 2021).

5.4 Comparison of the GCS and FOUR Score

The mean ± SD GCS was 11.23 ± 3.48 at admission, 11.6 ± 4.30 after 48 hours, and 12.23 ± 4.70 upon discharge from the ICU. These numbers indicate a better status than those reported by Kwamboka, (2020) it was 9 ± 4 upon admission, 9 ± 4 after 28 hours, and 10 ± 5 upon discharge. The mean ± SD of the FOUR score was 12.22 ± 4.10 upon admission, 12.38 ± 4.77 after 48 hours, and 12.47 ± 6.07 upon discharge. The numbers in this study indicate better consciousness than those reported by Kwamboka, (2020) it was 10 ± 4 upon admission, 10.7 ± 4.5 after 28 hours, and 11.3 ± 5 upon discharge.

Several studies have shown the inability of the GCS to assess the patient's verbal response, breathing rhythm, and brain reflexes. Hence, the GCS score could be lower than the FOUR score, potentially leading to incorrect interpretation of the patient's status (Aliakbar et al., 2016; Kwamboka, 2020; Sepahvand et al., 2016). The FOUR score was developed as an

alternative scale and some studies found it is more dependable and simpler to use (Kwamboka, 2020; Ramazani & Hosseini, 2022). The cut-offs in the present study were 6 for the GCS and 9 for the FOUR score, similarly to Kwamboka (2022). On other hand, Ramazani and Hosseini (2022) had different cut- off scores in three phases in their assessment of the LOC (8.5, 10.5, and 9.5) for the two scales.

In a study from Kenya, the researchers calculated the mortality rate by using a cut-off of 8 for the GCS and 9 for the FOUR score. There was a 2.7-fold increased risk of death for a GCS score less than 8 and a 2-fold greater chance of death for a FOUR score less than 11 (Abdallah, 2019).

5.5 Sensitivity of the GCS and the FOUR Score

The GCS score at admission was 13.8 times more likely to predict actual mortality accurately at the end of evaluation. In addition, the FOUR score at admission was 37.8 times more likely to predict actual mortality accurately at the end of evaluation. A study conducted in Egypt revealed that the FOUR score at admission was better than the GCS at admission in predicting mortality (92.3% and 46.5%) respectively (Shalaby et al., 2019).

The GCS and the FOUR score at admission had high sensitivity to predict mortality (97.4% and 94%, respectively). After 48 hours, the GCS still had higher sensitivity to predict patient mortality than the FOUR score (97.0% and 89.6% respectively). Both scales had 100% sensitivity to predict the mortality at the 1-month follow-up. This means that at admission and 48 hours after admission to the ICU, the GCS predicted mortality more

accurately than the FOUR score.

Kwamboka, (2020) found that neither the GCS nor the FOUR score could accurately predict mortality upon admission. However, the FOUR score was slightly better than the GCS, with 68% sensitivity compared with 48% sensitivity for the GCS in predicting survival rate. Therefore, the FOUR score is more trustworthy than the GCS. After 48 hours, the FOUR score had a 100% sensitivity in predicting mortality. Atthe end of the evaluation, the FOUR score had 100% sensitivity and the GCS had 98% sensitivity to predict survival (Kwamboka, 2020). In another study, the FOUR score had similar discrimination to the GCS (Amirtharaj et al., 2022). Sepahvand et al. (2016) reported that the GCS had higher sensitivity than the FOUR score (85% and 76%, respectively) but lower specificity (83% and 90%, respectively).

5.6Survival Analysis

The majority of patients in the present study were still alive at the 1-month follow-up.

GCS predicted 84.4% of patients would be living and live in actual. therefore, predicted 15.6 % of patients would be alive but died. However, the FOUR predicted 92.6% patients would be living and still alive in actual outcome. But it predicted for 7.4% of patients would be dead and actually died. Both scales had 100% sensitivity to predict mortality at the 1-month follow-up. According to Jalali and Rezaei (2014), the GCS and the FOUR score predicted 32% and 45.7% mortality, respectively, which means the FOUR scale had a stronger ability to predict mortality. actual mortality rate in this study was 20% after 1

month. This is similar to a 2-year study in Nigeria conducted on 2772 patient: The mortality rate was 22.2% (Otubogun, 2020).

At the end of evaluation, the specificity of the GCS and the FOUR score was 100% and 98%, respectively. This means that the FOUR scale was slightly more reliable than the GCS in assessing the consciousness of ICU patients.

This study is consistent with previous trials in indicating that the FOUR score is reliable. Gujjar et al. (2018) reported that the FOUR score is better than the GCS in assessing changes patients' consciousness in hospital wards. Indrawati et al. (2022) showed that the GCS and the FOUR score are useful tools for evaluating mortality in patients with head injuries, but the FOUR score is more suitable for individuals who require intubation. Nair et al. (2017) demonstrated that there is a significant difference between the FOUR score and GCS in predicting the severity of head injuries. They reported that the FOUR score is a more accurate to determine the state of awareness in patients who had head trauma. The FOUR score has promising predictive outcome potential and might be used routinely in the pre-hospital situation, particularly in intubated patients with brain injuries (Furman et al., 2020). Temiz et al. (2018) found that the FOUR score was superior to the GCS and was appropriate for evaluating the consciousness of patients.

On the other hand, many studies have disputed that the FOUR score is more reliable than the GCS. Ghelichkhani et al. (2018) showed that on the first assessment day, there was a visible change and both the GCS and the FOUR score are helpful in the neurological assessment of seriously ill patients and have nearly similar predictive power of mortality on discharge. Atahar et al. (2017) also demonstrated that the GCS and the FOUR score are

equally predictive of pediatric in-hospital mortality and death within 3 months after discharge. Another study in Turkey showed that both scales canbe utilized for neurological examination and ICU nurses can use both tools with confidence and without difficulty (Özçelik & Celik, 2021).

Chapter Six: Conclusion, Recommendations, Limitations and Budget.

6.1 Conclusion

Based on the finding, both FOUR scale and GCS have a good power in predicting patient's outcome and important to assess the LOC. But based on the high sensitivity and specificity of the FOUR scale, provide this instrument more accurate than the GCS in evaluating patients in the ICU. Although, the most patients in ICU are intubated and/or sedated, the FOUR scale is more comprehensive due to the ability to assess respiration and brainstem reflexes because it does not have a verbal component. So, the FOUR score was better at predicting mortality in patients admitted to the ICU.

6.2 Study limitations:

1. There is no hospital specialized in neurological diseases in Palestine. Thus, we had difficulty in collecting data from the appropriate patients.
2. There is no previous study has compared the GCS and the FOUR scale inPalestine.
3. There is a lack of knowledge about the FOUR score among health care providers.
4. This led to difficulty in collecting data and having to train a team for this process

6.3 Recommendations

1. Disseminate the current recommendations regarding the importance of both scales in ICUs.
2. Provide educational and training courses on how to use the FOUR score among health care providers.
3. Instruct nurses on how to assess the neurological condition of patients.
4. Use the FOUR score to assess the LOC of patients and to predict their outcomes in health care centers.
5. Use a larger sample size and conduct this study on a different group of patients.

6.4 Budget.

The research budget was formatted as a list or a table of equipment /consumables:

Table 6.4.1 The research budget.

Expense description	**Total cost**
Transportation	1000 ILS
Data analysis/Software	2000 ILS
Thesis book copies	1000 ILS
Miscellaneous	2500 ILS
Total	6500 ILS

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Appendix:

Annex (1): data collection sheet:

Data collection sheet Name of hospital: .....

Department ……

Date of admission …… date of discharge from ICU/death …….

Length of stay in ICU …….. .

Part 1: Demographic data and medical characteristics:

Age ……. Year **Gender:** M/F

Area: ……

Occupation ------ formal employment.

--- self-employment.

--- unemployed.

--- student.

--- other.

Educational level --------- illiterate.

--- school.

--- university.

Diagnosis ……

Past medical /surgical history ……

Patient sedated:

Yes ….. No……

Patient intubate: Yes …… No …..

Part 2: Glasgow coma scale

Glasgow coma scale	**Score on admission**	**Score after 48 hours**	**Score on discharge from ICU**
Eye opening			
4 = Spontaneous			
3 = To speech			
2 = To pain			
1 = no response			
Motor response			
6 = Obeying command			
5 = Localizing to pain			
4 = Withdrawal with pain			
3 = Flexion with pain			
2 = Extension to pain			
1 = No response			
Verbal response			
5 = Oriented			
4 = Confused			
3 =Inappropriate words			
2 = Inappropriate sound			
1 = No response			
Total of GCS			

Part 3: FOUR scale

FOUR scale	score on admission	Score after 48 hours	Score on discharge from ICU.
Eye response 4 = eyelids open or opened, tracking or blinking to command. 3 = eyelids open but not tracking. 2= eyelids closed, but open to aloud voice. 1= eyelids closed, but open to pain. 0 = eyelids remain closed with pain.			
Motor response 4= thumbs-up, fist or peace sign. 3 = localizing to pain. 2 = flexion response to pain. 1 = extension response to pain. 0= no response to pain or generalized myoclonus status.			
Brainstem reflexes 4= Pupil and corneal reflexes present. 3= One pupil wide and fixed. 2= Pupil or corneal reflexes absent. 1= Pupil and corneal reflexes absent 0= Absent pupil, corneal and cough reflex.			
Respiration 4 = not intubated, regular breathing. 3 = not intubated, cheyne – stocks breathing pattern. 2 = not intubated, irregular breathing 1 = breaths above ventilator rate. 0 = breaths at ventilator rate or apnea**.**			
FOUR score			

Part 4: patient outcomePatient actual outcome:

Alive ……. Death ……..

Predicted outcome by GCS:

Alive …. . Death ……

Predicted outcome by FOUR scale:

Alive …..

Death ….

Actual outcome:

Alive ……

Death. …….

Annex (2): Helsinki approval.

المجلس الفلسطيني للبحث الصحي

Palestinian Health Research Council

تعزيز النظام الصحي الفلسطيني من خلال مأسسة استخدام المعلومات البحثية في صنع القرار

Developing the Palestinian health system through institutionalizing the use of information in decision making

Helsinki Committee

For Ethical Approval

Date: 04/04/2022 **Number:** PHRC/HC/1066/22

Name: Basma Salameh and Woroud Mahmoud Omar الاسم:

We would like to inform you that the committee had discussed the proposal of your study about: نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم حول:

Comparison between full outline unresponsiveness score and Glasgow coma scale in predicting patient outcome in neurological disorder in ICU at al-najah national hospital : prospective observational cross sectional study

The committee has decided to approve the above mentioned research Approval number PHRC/HC/1066/22 in its meeting on 04/04/2022 و قد قررت الموافقة على البحث المذكور عاليه بالرقم والتاريخ المذكوران عاليه

Signature

Member Member

Chairman

Genral Conditions:-

1. Valid for 2 years from the date of approval
2. It is necessary to notify the committee of any change in the approved study protocol
3. The committee appreciates receiving a copy of your final research when completed

Specific Conditions:-

Annex (3): Facilitate the task .

Arab American University
Faculty of Graduate Studies

الجامعة العربية الأمريكية
كلية الدراسات العليا

حضرة السيد عبد الله قواسمة المحترم
مدير وحدة التعليم الصحي والبحث العلمي في وزارة الصحة الفلسطينية

الموضوع: تسهيل مهمة بحثية

تحية طيبة وبعد،

تهديكم كلية الدراسات العليا في الجامعة العربية الأمريكية أطيب التحيات، و بالإشارة إلى الموضوع أعلاه، وتماشيا مع سياسة دائرة التمريض في كلية العلوم الطبية المساندة/الجامعة العربية الأمريكية المتعلقة بتعزيز التعاون بين المؤسسات ووزارة الصحة الفلسطينية الموقرة بإتاحة فرص الإثراء العلمي للطلبة والخريجين في المؤسسات الوطنية وإسهامها في تنمية قدراتهم وخبراتهم نرجو من حضرتكم التكرم بالإيعاز لتسهيل مهمة الطالبة ورود محمود عمر والتي تحمل الرقم الجامعي 202012100 تخصص تمريض عناية مكثفة في كلية الدراسات العليا لاستكمال بحثها العلمي بعنوان:" مقارنة مقياس المخطط الكامل لدرجة عدم الاستجابة و مقياس غلاسكو للغيبوبة في توقع النتائج النهائية لمرضى الاضطراب الصدمي في وحدة العناية المكثفة " في مجمع فلسطين الطبي و مستشفى رفيديا الحكومي ، وذلك لأغراض البحث العلمي حيث سيكون الهدف من الدراسة :"المقارنة بين المقياسين و تحديد نسبة الوفاة لكلاهما و معرفة دقة كل مقياس في تحديد النتائج النهائية للمرضى " عن طريق تقييم المرضى عند دخولهم و تتبع حالتهم و تعبئة استمارة خاصة بكل مريض ، على أن تبدأ المهمة البحثية يوم الثلاثاء بتاريخ ٣/١٥ وتنتهي بالنهاء جمع العينة تحت إشراف (د. بسمة سلامة).

كما نود التنويه بأن الطالبة سوف تقوم بتقييم المرضى باستخدام المقياسين وتعبئة نتائج التقييم وذلك بعد الحصول على موافقة رسمية من حضرتكم وأيضا نتعهد بعدم ذكر أسماء المرضى مع حق المريض بالرفض في حال عدم موافقته للدخول للدراسة.

مع فائق الشكر والتقدير

د. نوار قطب
عميد كلية الدراسات العليا

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State of Palestine
Ministry of Health
General Directorate of Education in Health and Scientific Research

دولة فلسطين
وزارة الصحة
الإدارة العامة للتعليم الصحي والبحث العلمي

Ref.: ....
Date: ....

الرقم: ٢٠٢٢/٠٩٠/١٢٣
التاريخ: ٢٠٢٢/٤/٢٢

عطوفة الوكيل المساعد لمجمع فلسطين الطبي المحترم،،،
الأخ مدير عام الادارة العامة للمستشفيات المحترم،،،
تحية واحتراماً،،

الموضـــوع: تسهيل مهمة بحث

يرجى التكرم بتسهيل مهمة الطالبة: ورود محمود يوسف عمر، ماجستير تمريض العناية المكثفة- الجامعة العربية الامريكية، لعمل بحث بعنوان:

"مقارنة المقياس المخطط الكامل لدرجة عدم الاستجابة ومقياس غلاسكو للغيبوبة في توقع النتائج النهائية لمرضى الاضطراب العصبي في وحدة العناية المكثفة"

حيث ستقوم الطالبة بجمع معلومات من خلال تعبئة استمارة خاصة بكل مريض عند دخولهم وتتبع حالتهم الصحية بعد موافقة رئيس قسم المختص، ذلك في:

- جميع المستشفيات الحكومية ومجمع فلسطين الطبي

وذلك تحت اشراف د. بسمة سلامة، في الفترة ما بين 2022/3/20- 2022/6/1.
على ان يتم الالتزام بالمحافظة على اخلاقيات البحث العلمي وسرية المعلومات.
على ان يتم الالتزام بجميع تعليمات وإجراءات الوقاية والسلامة الصادرة عن وزارة الصحة بخصوص جائحة كورونا، وتحت طائلة المسؤولية، وابراز شهادة التطعيم قبل دخول مرافق وزارة الصحة.
على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التعهد بعدم النشر لحين الحصول على موافقة وزارة الصحة.

مع الاحترام،،

د. عبد الله القواسمي
رئيس وحدة التعليم الصحي والبحث العلمي

نسخة: عميد كلية الدراسات العليا المحترم/ الجامعة العربية الامريكية

Telfax: 09-2333901   [illegible]   تلفاكس: 09-2333901

Annex (4): consent form.

إقرار الموافقة على المشاركة في بحث علمي

أنا الموقع أدناه قد فهمت المعلومات المقدمة لدي عن البحث وقد تمت الإجابة على كافة أسئلتي بشكل مُرضي، أوافق على المشاركة مع احتفاظي بالحق في أن أنسحب من البحث في أي وقت دون سبب ومن دون وقوع ضرر عليّ او تحيز ضدي في أي وقت.

وقد أبلغت بأهداف البحث والبيانات التي سيتم جمعها وكيفية التعامل مع هذه البيانات بعد الانتهاء من البحث.

وأنا أفهم أن جميع المعلومات التي أدلي بها أو يتم جمعها عني ستعامل بسرية تامة ولن تعلن بأي شكل قد يؤدي إلى التعريف بهويتي . كما أوافق على أنه يمكن نشر بيانات البحث مع مراعاة سرية المعلومات كما ذكر أعلاه.

رقم هاتف المشارك / من ينوب عنه : .....

توقيع المشارك في البحث / من ينوب عنه : .....

توقيع الباحث : .....

لمعرفة المزيد عن هذه الدراسة الرجاء الاتصال على الرقم 0569162398 او التواصل من خلال البريد الالكتروني w.omar@student.aaup.edu

ملخص باللغة العربية

مقارنة بين درجة عدم استجابة المخطط التفصيلي الكامل ومقياس غيبوبة غلاسكو في التنبؤ بنتائج مرضى الاضطراب العصبي في وحدات العناية المركزة: دراسة مقطعية مستعرضة قائمة على الملاحظة.

تقييم الحالة العصبية هو عنصر مهم في تقييم حالة المريض والتنبؤ بنتائجه. تم استخدام مقياس غلاسكو ومقياس درجة عدم استجابة المخطط التفصيلي الكامل في تقييم الحالة العصبية للمرضى.

كان الهدف الرئيسي من هذه الدراسة هو القارنة بين هذان المقياسان بين مرضى الاضطرابات العصبية في مراكز العناية المكثفة في الضفة الغربية.

المنهجية: كان تصميم الدراسة عبارة عن دراسة مقطعية كمية ومستقبلية قائمة على الملاحظة. شارك جميع المرضى الذين تم قبولهم في العناية المكثفة في مستشفى النجاح الوطني الجامعي والمستشفى الوطني مستشفى رفيديا. استوفى معايير التضمين في هذه الدراسة 84 مريض. تم تجميع هذه البيانات من قبل الباحث وفريق متدرب من الممرضين وتم استخدام أداة جمع البيانات التي تحتوي على البيانات الديموغرافية وتقييم المرضى عن طريق مقياس غلاسكو ومقياس درجة عدم استجابة المخطط التفصيلي الكامل ومن ثم النتيجة التنبؤية والفعلية لكل مقياس.

تم تقييم 84 مريضاً، 69% من المرضى كانوا ذكوراً ومتوسط العمر 48 سنة ومتوسط الإقامة كان 6.4 يوم. عند تقييم المريض بمقياس غلاسكو بمستوى منخفض أقل من 6 عند الدخول، بعد 48 ساعة وعند الخروج من قسم العناية المكثفة كانت النتائج (8%، 14%، 19%) على التوالي. أما بالنسبة لمقياس درجة عدم استجابة المخطط التفصيلي الكامل كان أقل من 9 بنتائج (19%، 25%، 20%) على التوال. عند قياس حساسية كلا المقياسين عند الدخول كانت النتيجة لمقياس غلاسكو عند الدخول (94%، 97.4%) للمقياس الآخر. أما عند الخروج فكانت لكلا المقياسيين 100%. تم تحليل الخصوصية لكلاهما عند الدخول وعند الخروج فكانت لمقياس غلاسكو (29%، 94%) على التوالي وللمقياس الآخر كان (70%، 100%) على التوالي.

كانت الخلاصة من هذه الدراسة أن كلا المقياسيين قادران على التنبؤ بنتائج المرضى بنسبة

كبيرة ولكن يعتبر مقياس درجة عدم استجابة المخطط التفصيلي الكامل أفضل وأكثر دقة من مقياس غلاسكو.