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Development and use of clinical vignettes to assess injury care quality in Northern Malawi

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**Conflict of interest:** All authors declare no conflict of interest.

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**Ethical Considerations**
The study was explained and participants given information sheets. Any questions were answered and participants signed a consent form, confirming agreement to participate. The Malawi National Health Sciences Research Committee (19/03/2263) and the UK MOD Research and Ethics Committee (960/MODEC/19) approved the study.

**Highlights**

- Across low-and-middle income countries (LMICs), little is known about the delivered quality of care following injury.

- Methods to assess clinical care quality following injury in LMICs, where 90% of deaths occur, are urgently needed.

- Clinical vignettes facilitate standardised comparison and offer a pragmatic method for assessing provider care quality.

- This study developed, piloted and used 4 clinical vignette scenarios to assess injury care quality in LMICs.

- These vignettes are easy to use, collect rich data, and aid assessing care quality, particularly when other methods are not feasible.

**Keywords:**

Wounds and Injuries, Developing Countries, Quality of Health Care, low- and middle-income country, assessment, vignettes.

**Abstract:**

**Background**

It is known that outcomes after injury care in low-and-middle income countries (LMICs) are poorer than those in high income countries. However, little is known about healthcare provider competency to deliver quality injury care in these settings. We developed and used clinical vignettes to evaluate injury care quality in an LMIC setting.

**Method**

Four serious injury scenarios, developed from agreed best practice, testing diagnostic and management skills, were piloted with high and low-income setting clinicians. Scenarios were used with primary and referral facility clinicians in Malawi. Participants described their clinical course of action (assessment, diagnostic, treatment and management approaches) for each scenario, registering one point per agreed best practice response. Mean percentage total scores were calculated and univariable and multivariable comparison made across provider groups, facility types, injury care frequency and training level.

**Results**

Fourteen Doctors, 51 Clinical Officers, 20 Medical Assistants from 11 facilities participated. Mean percentage total vignette scores varied significantly with clinician provider group (Doctors 63.1% vs Clinical Officers 49.6%, $p<0.001$, Clinical Officers vs Medical Assistants 39.4% $p=0.001$). Important care aspects most frequently included or omitted were: following chest injury, 88.2% reported chest drain insertion, 7.1% checked for tracheal deviation; following penetrating abdominal injury and shock, 98.8% secured IV access, 0% mentioned tranexamic acid; following severe head injury, 88.2% proposed CT or neurosurgical transfer, 7.1% ensured normotension; and following isolated open lower leg fracture, 90.1% arranged orthopaedic consultation, 2.4% assessed distal neurological status.

**Conclusion**

These clinical vignettes proved easy to use and collected rich data. This supports their use for assessing and monitoring clinical care quality in other similar settings.

## Introduction:

Injury accounts for 8% of global deaths [1] and 90% of all injuries occur in Low and Middle Income Countries (LMICs) [2]. Deaths from Road Traffic Collisions continue to rise, reaching 1.35 million in 2016 [3]. Non-fatal injury burden is huge with one billion people sustaining injuries warranting healthcare in 2013 [4]. One third of global trauma deaths could be avoided if high-income country survival rates were achieved in LMICs [5], making a strong case for research and investment in LMIC trauma health systems. Improved care access is important, but ensuring delivered care is high quality needs increased attention [6].

Within Malawi, injury is a substantial cause of mortality and morbidity accounting for 19% of non-communicable disease and injury (NCDI) disease adjusted life years (DALYs) and 6.4% of all deaths [7]. Young and economically active individuals are predominantly affected; two thirds of Malawians are aged under 40 [8] but this age-group experience 82% of injury burden [7]. The health system however lacks facility-based human and physical resources needed for injury care [9].

Across LMICs, little is known about delivered quality of care following injury [6]. Studies focus on facility resource capacity, but evidence suggests physical resource and care quality are not well correlated [10]. Routinely collected medical records are usually insufficient to assess the quality of trauma care as they are commonly neither consistent, complete nor integrated between departments or facilities [11, 12]. Trauma registries document facility care delivery for injured persons and are advocated for describing epidemiology, monitoring care quality and providing evidence for prevention initiatives [13]. However, registry data can be limited by the predefined variables included, which may not capture sufficient detail about delivered care; low variables completion rates further hinders this [14]. Trauma registries are scarce in LMICs and particularly Malawi, present in few facilities in Lilongwe and Blantyre [14, 15]. Other approaches are therefore needed to understand trauma care quality [16].

Clinical vignettes are used to assess provider care quality [17, 18]. Though definitions vary, all aim to assess clinician behaviour in a controlled standardised manner [19]. Some studies used written or computer-based scenario assessment. Others used actors with the healthcare workers' (HCW) knowledge, distinct from standardised patients, where HCWs are unaware presenting patients are actors [20]. Standardised patients are inappropriate for many acute conditions, particularly serious conditions, like trauma, requiring urgent intervention. Vignettes compare with standardised patients and case note review of patient-provider interactions in HIC settings for non-trauma care [21]. Vignettes are inexpensive compared to direct observation and reviewing medical records [22], which are also subject to the limitations of feasibility, sample size, and reporting accuracy [23]. Vignettes facilitate standardised comparison of clinicians across facilities [22] and therefore offer a pragmatic method for assessing provider care quality.

This study aimed to develop, test and use clinical vignettes to evaluate injury care quality in Northern Malawi.

**Methods:**

**Development of vignettes**

We developed vignettes between January and March 2019 using Primary Trauma Care (PTC) principles. PTC, based on Advanced Trauma Life Support guidelines, focusses on low resource setting care [24, 25]. We created four hypothetical scenarios: blunt chest injury causing tension pneumothorax, penetrating abdominal injury with hypovolaemic shock, severe head injury, and lower limb isolated open fracture. These life or limb threatening injuries test a range of diagnostic and management skills for individual patient care. They cover 8 of WHO's Essential Trauma Care 11 "specific medical goals" [26, 27], and 2 Lancet Commission on Global Surgery "bellwether" surgical procedures [28]. Important aspects constituting good quality care were identified from PTC principles and incorporated into the scenarios.

Two senior experienced trauma providers, 1 male and 1 female, based in South Africa, reviewed the scenarios for applicability to LMIC settings. Following revision, they were piloted with providers experienced with trauma care in UK (5 male), Sierra Leone (1 male), the Democratic Republic of Congo (DRC) (1 female) and Malawi (1 male), prompting minor adjustments. All were purposively sampled from the authors' network of trauma and research contacts.

**Study setting**

The study was focussed on the health system serving the Karonga Demographic Surveillance Site (DSS), Karonga District, Northern Malawi [29]. Karonga is a predominantly rural lakeshore district, typical of a Malawian subsistence economy community dependent on farming and fishing [29] with a population of over 350,000. The main tarmac road runs through the district with mostly gravel secondary roads. The population is served by local primary facilities run by the government (including a military facility accessible by civilians), private and faith based providers; secondary care facilities include a government facility 70km North and faith based provider facility 40km South over difficult hilly terrain. Tertiary care is provided in a government facility in the regional capital Mzuzu, 150km South.

In addition to doctors, Clinical Officers and Medical Assistants are non-physician clinicians providing important diagnostic and clinical care functions for the population of Malawi and may practice independently [30]. Medical Assistants, Clinical Officers, and Doctors have completed post-secondary training of a 2 year clinical medicine certificate, 3 year clinical medicine diploma, and 6 year Bachelor's degree respectively [9]. All provide immediate care to injured patients including initial assessment and management. Primary facilities are usually staffed by Medical Assistants and Clinical Officers. There is no established pre-hospital emergency medical service. Injured patients commonly present to primary facilities initially rather than bypassing to secondary or tertiary care.

**Identification of participants**

All facilities likely to care for injured people were identified by DSS staff. Clinical leads for each facility were approached for permission to conduct the study. All clinicians (Doctors, Clinical Officers and Medical Assistants) who would be involved in the treatment of the injured and were available (e.g. not on leave) during the facility visit were invited to take part. We employed a pragmatic, purposive, opportunistic sampling strategy, comparable with that adopted by others using vignettes as a marker of care quality across LMIC facilities [31, 32].

**Conduct of Vignettes**

Vignettes were conducted in English as Malawian clinicians are fluent, with English the language of University clinical education. They took place at participants' convenience, in quiet private locations. One author (JW) conducted each vignette, taking approximately 30 minutes each.

Participants were asked how frequently they provided injury care (at least daily, weekly, monthly, quarterly, or annually) and their level of formal injury care training (none, training received during qualification, post-qualification training totalling less than 10 days, or substantial post-qualification training including formal qualifications, placements, fellowships, or courses more than 10 days). Each scenario was read to participants who freely explained their actions to assess, diagnose, treat, and further manage the patient. The scenario was available in written form throughout to allow clarification.

Predefined important aspects of care mentioned were noted on scoresheets. Participants were encouraged to mention anything they would ideally do but were unable and provide reasons. Prompting was avoided, although clarifications were asked if descriptions were unclear.

Once participants were satisfied they had mentioned everything they would do, additional clinical information was provided for scenarios 1, 2, and 3 (Figure 1). All information was provided upfront for scenario 4 as important care aspects were not dependent on additional assessment findings. All additional information was provided, whether or not the participant had described prerequisite assessment.

**Data collection**

Vignettes were conducted between July and November 2019. Site visits to facilities took a maximum of 5 consecutive days. The scoring scheme was not revealed to participants. Scoresheets were entered into a REDCap [33] database, rechecked by one author (JW).

**Analysis**

Participant characteristics are described. For each vignette, one mark was assigned per important aspect of injury care mentioned. A score per participant was calculated for each scenario separately and combined. The percentage of the maximum available score per participant was calculated.

After distributions were confirmed as normal through assessment of kurtosis and skewness (appendix Figure 1 and table 3), the mean (standard deviation) percentage score for each individual-scenario and combined scenarios are described as follows: across all participants; across provider groups (Doctor, Clinical Officer, or Medical Assistant); across facility types (referral [secondary or tertiary] or primary); across frequency of injury care provided (at least weekly or less than weekly); and injury care training level (any postgraduate training or no postgraduate training). Between group comparisons used student's t-test. A multivariable linear regression model assessed the effects of independent variables of provider groups, facility type, frequency of injury care, and injury care training level and each of the dependent variables of total percentage score or score per scenario. For anonymity, named facility-level analysis was not conducted. Analysis used SPSSv26.0.

**Results:**

No clinicians declined to participate. Eighty five clinicians completed the vignettes; 14 generalist Doctors, 51 Clinical Officers, and 20 Medical Assistants. Participants were from 11 facilities including 3 referral (secondary or tertiary care) hospitals and 8 primary (locally designated rural hospitals or smaller). Only 35.3% (30) of participants reported any postgraduate injury care training. The minimum reported frequency for treating an injured person was quarterly and 64.7% (55) reported caring for an injured person at least weekly (Table 1).

Reported aspects of care for each scenario are shown in Table 2 with the most and least commonly reported presented here. No individual scored 100% in any scenario. In scenario 1 (Figure 2a), the chest injured patient, placing a chest drain, or arranging transfer to a facility able to, was most common, 88.2%. Least commonly performed was feeling for tracheal deviation, 7.1% (6). In scenario 2 (Figure 2b), a patient in shock following penetrating abdominal injury, all but 1 participant, 98.8%, mentioned securing IV access. No participant, 0%, mentioned tranexamic acid. In scenario 3 (Figure 2c), a severe head injured patient, 88.2% (75) of participants proposed either a CT scan or transfer to a clinician who could operate on the skull. Only 7.1% (6) ensured a normal blood pressure. In scenario 4 (Figure 2d), a patient with isolated open lower leg fracture, a surgical or orthopaedic consultation was proposed by 90.1% (77). Assessing lower limb distal neurology was mentioned by 2.4% (2).

The mean percentage total score for all participants across all scenarios combined was 49.4% (SD 13.4); scenario 1, 51.7% (SD 17.9); scenario 2, 52.9% (SD 15.3); scenario 3, 43.5% (SD 21.4); and scenario 4, 48.8% (SD 16.7). On univariable testing, the mean percentage total score for Doctors (63.1%, SD 11.8) was higher than Clinical Officers (49.6%, SD 11.8) $p<0.001$, and for Clinical Officers was higher than Medical Assistants (39.4%, SD 9.92) $p=0.001$ (Table 3). The mean percentage total score was also higher for respondents working in referral hospitals (51.0%, SD 13.8) compared with primary facilities (43.4%, SD 10.1) $p=0.031$. Those seeing injured patients at least weekly had higher mean percentage scores than those treating injuries less frequently, although not statistically significant (51.4% vs 45.9% $p=0.071$). Those with post-qualification training in the care of the injured had higher mean percentage total scores, but again not statistically significant (52.0% vs 48.0% $p=0.186$). On multivariable analysis, adjusting for facility type, frequency of injury care and injury care training level did not substantially alter the relationship between provider group and mean total score. However, the relationship between facility type and score became non-significant (Appendix Table 1).

When participants responded that they would ideally do something that in reality was impossible, the reason usually related to lacking physical resources (Appendix Table 2).

**Discussion:**

This study developed, tested and used clinical vignettes, applicable to LMIC settings, to assess quality of clinical care following injury. These vignettes are easy to use, collect rich data, and provide a vehicle for assessing clinical care quality, particularly when opportunities for other methods such as direct observation and medical records review are limited.

Overall, doctors and those working in referral centres were more likely to perform important aspects of care. Whilst resource deficiencies sometimes hampered optimal care, some important processes were commonly omitted despite availability of required resources. The study has demonstrated important aspects of care frequently included and others commonly omitted in clinical practice.

Some specific results are worth further discussion. First, in patients at risk of traumatic bleeding, IV tranexamic acid reduces all cause and bleeding related death in settings including Sub-Saharan LMICs [34]. Although cheap and a WHO core Essential Medicine [35], this was not mentioned by any respondent and it is likely that participants were unaware of this indication. Second, the WHO Essential Trauma Care guidelines emphasise secondary preventative measures following head injury as essential from primary level facilities upwards [27]. Most head injury mortality is associated with secondary injury [36] potentially amenable to simple therapies. However, few participants took such measures as avoiding hypoxia, hypotension and nursing patients head up. This is despite oxygen therapy and IV access being available and nursing head up having minimal resource implications. Third, both prompt administration of antibiotics and documented examination of neurovascular status are key features of the Malawi Orthopaedic Association (MOA) guidelines for management of open fracture [37]. Few participants gave antibiotics, or checked for distal neurological or vascular compromise, which are potentially simple examination techniques to identify need for urgent intervention. There are currently no national trauma protocols in Malawi, apart from those produced by the MOA. These findings show the need to develop and widely disseminate local trauma care protocols, raise clinicians awareness of their existence, and provide appropriate training.

Clinician mean total vignette scores varied with cadres, highest for Doctors, then Clinical Officers, then Medical Assistants. Similar findings of improved vignette performance by doctors compared to non-physician clinicians has been shown in sub-Saharan African primary care settings [18]. However, for surgical procedures in orthopaedics within Malawi [38] and Caesarean sections in Sierra Leone [39] outcomes were non-inferior when performed by non-physician clinicians compared to doctors. This study's vignettes aren't designed to assess specific procedural competence but rather patient assessment and management decisions across a wider breadth of traumatic presentations. Malawi has one of the highest ratios of non-physician clinicians to population (22.2 per 100,000 population) and most clinicians are non-physicians [30]. Given the increasing burden of injury within Malawi [15] ensuring the care quality provided by all healthcare workers in the immediate management of injury should be prioritised.

On multivariable analysis we did not find that injury care training level, frequency of injury care, or facility type significantly affected total scenario scores. Data collected on injury care training may not have been adequate to understand details of the specific nature of the training or how recently it was completed. Given that most of the post graduate training was reported by clinical officers, it may not have been enough to overcome the training effect of additional undergraduate education also received by doctors. Vignette scores did not demonstrate a difference between higher and lower frequency of injury case management, or primary and referral facilities. This is not in keeping with high income country evidence that higher trauma centre patient volume being associated with lower odds of death for more severe trauma patients [40]. Similarly across a range of medical and surgical conditions facility and provider case volume is associated with better outcomes [41]. Improved outcomes depend on more than clinician care processes such as factors related to facility resource and the wider healthcare team. Workload has however been shown to correlate with vignette derived provider competence scores in emergency obstetric care in Ghana [42]. This may be due in part to the relatively higher priority given to investment in maternal care services compared to injury.

Trauma care vignettes for assessing care quality in LMICs is novel, however, they have been increasingly employed for other conditions. These include TB care in India [32, 43], obstetric and new-born care in Ghana and Bangladesh [31, 42] and diarrhoea in Kenya, Ghana and India [44, 45]. Vignettes have also been used to gauge patient expectations of poor quality care (anchoring)[46] in health system care quality research studies. As in our study, scenarios are commonly developed from and scored against corresponding best practice guidance [31, 42, 45]. Some vignettes only reveal clinical findings when specifically requested by the provider [43], whilst others provide all required information within the scenario [17, 42, 45] whether or not specifically requested. We opted to provide sufficient follow up information to allow providers opportunity to describe subsequent best treatment. We chose not to limit vignettes to a particular frequency of exposure to injured patients. Other studies have adopted a similar approach for other conditions in order to ensure those who might have responsibility for such cases are included [31, 43]. Whilst others have selected the most experienced (and assumed most competent) provider within the facility as a proxy for the facility [17, 42, 45]. As we did, using open ended questions as a vignette approach is common in other studies [45] and continually asking participants if they would do anything else until the answer was no, was also the approach used in other studies [17, 42]. Other studies have also focussed on both the diagnostic process and the correct subsequent treatment of vignette cases [17, 31, 42, 43, 45]. Vignette scoring can sometimes be weighed in favour of care process elements deemed more important or lifesaving [17, 42, 45] although simpler scoring of one point per item is often adopted for pragmatic simplicity [42] as in our study. Where studies have been conducted across levels of facility (primary and referral) other vignettes have incorporated the ability for providers to gain a vignette score by referring to a facility able to undertake the procedure [42]. Structured answer forms, as we used, are common and investigators believe this protects against inter and intra observer variability [31]. Some studies with greater resource have used supervisor double scoring of a sample of vignettes as a control of consistency [45] which could be employed in future.

Studies applying vignettes for care quality assessment have asserted that strengths include their low cost and pragmatic application to rapidly assess care quality with limited resources compared to alternatives such as observation [31]. Since they do not depend on either the providers' routine workload nor by patient selection of provider they are useful for comparison between provider types, healthcare facilities and location [45, 47].

Our study had limitations. Comprehensive validation of such a tool is a challenge. Where vignettes have been validated as measures of care process quality, standardised patients have been used and proposed as the gold standard against which vignettes should be validated [47]. However standardised patients are unsuitable for cases such as trauma where physiological or anatomical signs and symptoms are relied upon and invasive procedures may be required [48]. In conditions where such validation has been performed a “know-do” gap has been evidenced [44]. This is where providers are more likely to describe an aspect of care during vignettes, than they are to demonstrate it during standardised patient assessment. Thus, our vignettes are likely to produce an overly positive score of provider competency. Validation through direct observation of care, which has been advocated to enhance care quality assessments [19], poses difficulties due to the unpredictable nature of trauma case presentation and the reproducibility of injury mechanisms and patterns. The WHO trauma care checklist, though primarily to guide providers, can aid recording observed trauma care quality [49]. Moulage scenarios maybe a possible alternative, although they themselves would require validation, as well as substantial additional resource. Some vignette study authors have suggested that higher scores in “higher cadres” of care providers, doctors in our study, acts itself to validate the vignette for assessing competence [42]. We did not compare better process quality with improved patient outcomes, the ultimate aim of healthcare processes [50]. Further study of the validity and reliability of these vignettes is an important subject for future research.

It was theoretically possible for colleagues to discuss scenarios amongst each other, and practically impossible to definitively prevent. However, in the facility with the largest number of participants, plotting total percentage score per participant against consecutive participants does not demonstrate improvement over time. This suggests that either discussion between colleagues about the scenarios did not take place, or if it did, it did not positively influence the percentage total score (Appendix 3). We used a single interviewer for this study which does not allow for inter observer comparison. Both single interviewers and single vignette scorers are however common in vignette assessments of care process quality [17, 31, 45]. Potential advantages to a single interviewer include pragmatism of conducting such studies where time an resource may be constrained and the ability to establish a rapport with the participant. A formal sample size calculation was not done as the primary aim was development and testing of vignettes and these formal comparisons were exploratory. However, we did choose a similar sample size to those used in other LMIC based vignette studies. [17, 31, 42]

Clinician subspecialisation, undertaken by some Clinical Officers in Malawi was not captured. Orthopaedic Clinical Officers for example may lead the management of certain injuries in some

facilities [51]. This study did not capture how recently post-qualification injury training had occurred. Knowledge and skills learnt during training courses could decline over time [52]. Capturing this information, along with specific training received, could enable training effects to be better evaluated. Non-technical aspects of care quality such as the patient experience were not captured. Ethical, respectful and compassionate care are also core components in high quality healthcare [6].

**Conclusion:**

To our knowledge this is the first study using clinical vignettes to assess injury care quality in an LMIC. The approach could also be used in other settings to measure of injury care quality and offers a method to evaluate changes in care quality over time following interventions such as guideline development and dissemination.

**Table 1 Characteristics of Vignette participants**

| | | Doctor N/14 (%) | Clinical Officer N/51 (%) | Medical Assistant N/20 (%) | All N/85 (%) |
|---|---|---|---|---|---|
| Facility type | Referral | 14 (100) | 45 (88.2) | 8 (40.0) | 67 (78.8) |
| | Primary | 0 | 6 (11.8) | 12 (60.0) | 18 (21.2) |
| | | | | | |
| Frequency of injury care | Daily | 5 (35.7) | 12 (23.5) | 0 | 17 (20.0) |
| | Weekly | 9 (64.2) | 20 (39.2) | 9 (45.0) | 38 (44.7) |
| | Monthly | 0 | 17 (33.3) | 5 (25.0) | 22 (25.9) |
| | Quarterly | 0 | 2 (3.9) | 6 (30.0) | 8 (9.4) |
| | Annually | 0 | 0 | 0 | 0 (0) |
| | | | | | |
| Injury care training level | Any postgraduate injury care training | 4 (28.6) | 24 (47.1) | 2 (10.0) | 30 (35.3) |
| | No postgraduate training | 10 (71.4) | 27 (52.9) | 18 (90.0) | 55 (64.7) |

**Table 2 Detailing aspects of care mentioned for each of the 4 scenarios, presented in order of positive responses.**

| **Best Practice Item** | **Would be done, n/85 (%)** | **Would ideally like to do, n/85 (%)** | **Not mentioned, n/85 (%)** |
|---|---|---|---|
| **Scenario 1 introduction**<br>*A middle-aged farmer was kicked in the chest by a cow about 2 hours ago. He complains of pain in his right chest and difficulty in breathing. What would you do for this patient?* | | | |
| Give oxygen | 66 (77.6) | 5 (5.9) | 14 (16.5) |
| Listen to the chest for breath sounds with stethoscope | 58 (68.2) | 0 (0) | 27 (31.8) |
| Look for evidence of chest deformity or penetrating injury | 46 (54.1) | 0 (0) | 39 (45.9) |
| Feel (observe) chest wall expansion | 46 (54.1) | 0 (0) | 39 (45.9) |
| Check pulse rate | 38 (44.7) | 0 (0) | 47 (55.3) |
| Check for cyanosis OR Check oxygen saturations | 38 (44.7) | 0 (0) | 47 (55.3) |
| Count respiratory rate | 33 (38.8) | 0 (0) | 52 (61.2) |
| Percussion of the chest | 32 (37.6) | 0 (0) | 53 (62.4) |
| Check level of consciousness | 28 (32.9) | 0 (0) | 57 (67.1) |
| Signs of respiratory distress – short sentences, ala flaring, sweaty | 18 (21.2) | 0 (0) | 67 (78.8) |
| Feel for tracheal deviation | 6 (7.1) | 0 (0) | 79 (92.9) |
| **Scenario 1 additional information**<br>*The patient is breathing 30 breaths per minute with evidence of hypoxia. You discover that the patient has reduced breath sounds on the right side. The chest wall is not moving much on the right side. The trachea seems to be shifted to the left and there is increased resonance on percussion. What would you do for this patient?* | | | |
| **Scoring Item** | **Would be done, n/85 (%)** | **Would ideally like to do, n/85 (%)** | **Not mentioned, n/85 (%)** |
| Placement of a chest drain OR arrange immediate transfer to facility that can perform this procedure | 75 (88.2) | 0 (0) | 10 (11.8) |
| Follow up chest x-ray OR arrange for transfer to facility that can arrange an x-ray / chest drain care. | 46 (54.1) | 0 (0) | 39 (45.9) |
| Needle decompression or Thoracostomy | 42 (49.4) | 1 (1.2) | 42 (49.4) |
| Pain relief | 37 (43.5) | 0 (0) | 48 (56.5) |
| **Scenario 2 introduction**<br>*A 20-year-old male is brought in by friends to the facility. They tell you he has been stabbed with a knife less than one hour ago. He has rapid shallow breathing, his radial pulse is fast over 110 beats per minute. He is complaining of pain in his abdomen. What would you do for this patient?* | | | |
| **Scoring Item** | **Would be done, n/85 (%)** | **Would ideally like to do, n/85 (%)** | **Not mentioned, n/85 (%)** |
| IV access | 84 (98.8) | 0 (0) | 1 (1.2) |
| Consider a blood transfusion if needed | 54 (63.5) | 3 (3.5) | 28 (32.9) |
| Primary survey | 52 (61.2) | 0 (0) | 33 (38.8) |
| Consider an investigation if available – FAST, CT, DPL | 44 (51.8) | 7 (8.2) | 34 (40.0) |
| Check blood tests including Haemoglobin | 40 (47.1) | 1 (1.2) | 44 (51.8) |
| Administer pain relief | 26 (30.6) | 0 (0) | 59 (69.4) |
| Look for other stab wounds* | 20 (23.5) | 0 (0) | 65 (76.5) |
| Consider Tranexamic acid | 0 (0) | 0 (0) | 85 (100.0) |

| **Scenario 2 additional information**<br>*On examination you find only 1 stab wound in the anterior aspect of the lower right quadrant of the abdomen. The blood pressure is 85/60.*<br>*What would you do for this patient?* | | | |
|---|---|---|---|
| **Scoring Item** | **Would be done, n/85 (%)** | **Would ideally like to do, n/85 (%)** | **Not mentioned, n/85 (%)** |
| Prepare for laparotomy OR Arrange urgent transfer for facility that can perform laparotomy | 74 (87.1) | 0 (0) | 11 (12.9) |
| **Scenario 3 introduction**<br>*A 19 year old girl was working on the roof of her home. She slipped and fell off hitting her head on the ground about 3 hours ago. She was initially behaving normally but then became confused and vomited several times. She started to become drowsy and so her family brought her to the facility by taxi. What would you do for her?* | | | |
| **Scoring Item** | **Would be done, n/85 (%)** | **Would ideally like to do, n/85 (%)** | **Not mentioned, n/85 (%)** |
| Primary survey assessment | 57 (67.1) | 0 (0) | 28 (32.9) |
| Assessment of conscious state either AVPU or GCS | 53 (62.4) | 0 (0) | 32 (37.6) |
| Protection of the cervical spine | 36 (42.4) | 0 (0) | 49 (57.6) |
| Assessment of pupil size and reactivity to light | 29 (34.1) | 0 (0) | 56 (65.9) |
| **Scenario 3 additional information**<br>*You find that she opens her eyes only when stimulated by pain and brushes your hand away when causing pain but does not obey your commands. She is using words, but they don't make any sense. Her right pupil is 6mm in size and not reacting much to light. Her left pupil is 3mm and reacts normally to light. She has a swelling and bruise on the left side of her head. What would you do for her?* | | | |
| **Scoring Item** | **Would be done, n/85 (%)** | **Would ideally like to do, n/85 (%)** | **Not mentioned, n/85 (%)** |
| CT scan OR Assessment by clinician able to operate on the skull OR transfer to hospital with neurosurgeon. | 67 (78.8) | 8 (9.4) | 10 (11.8) |
| Avoid hypoxia | 40 (47.1) | 1 (1.2) | 44 (51.8) |
| Consider mannitol OR hypertonic saline | 37 (43.5) | 3 (3.5) | 45 (52.9) |
| Elevate the head of the bed | 16 (18.8) | 0 (0) | 69 (81.2) |
| Consider need for intubation | 15 (17.6) | 2 (2.4) | 68 (80.0) |
| Maintain normal blood pressure | 6 (7.1) | 0 (0) | 79 (92.9) |
| **Scenario 4 all information**<br>*A 40-year-old motorcyclist was hit by a taxi on the main road 3 hours earlier. He is complaining of severe pain in his left lower leg. You examine his head, neck, chest abdomen and pelvis and do not find any significant abnormality. His heart rate is 90 beats per minute. There is a wound with visible bone and obvious deformity suggesting fracture of his left lower leg. What would you do for this patient?* | | | |
| **Scoring Item** | **Would be done, n/85 (%)** | **Would ideally like to do, n/85 (%)** | **Not mentioned, n/85 (%)** |
| Surgical / Orthopaedic Consultation | 77 (90.6) | 0 (0) | 8 (9.4) |
| Immobilise the limb | 70 (82.4) | 0 (0) | 15 (17.6) |
| Pain relief | 60 (70.6) | 0 (0) | 25 (29.4) |
| X-ray | 51 (60.0) | 8 (9.4) | 26 (30.6) |
| Antibiotics | 38 (44.7) | 0 (0) | 47 (55.3) |
| Consider tetanus immunization | 22 (25.9) | 0 (0) | 63 (74.1) |

| | | | |
|---|---|---|---|
| Assess the pulses in the limb | 4 (4.7) | 0 (0) | 81 (95.3) |
| Assess the neurological status in the foot | 2 (2.4) | 0 (0) | 83 (97.6) |
| | | | |
| Notes<br>*The exact location of the stab wound was not mentioned initially to allow participants to describing looking for other wounds. | | | |

**Table 3 showing mean percentage vignette scores (total and per scenario) across provider group, facility type, frequency of injury care and injury care training level.**

| | | Total Mean percentage score (SD) | P value | Scenario 1 Mean percentage score (SD) | P value | Scenario 2 Mean percentage score (SD) | P value | Scenario 3 Mean percentage score (SD) | P value | Scenario 4 Mean percentage score (SD) | P value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | All | 49.4 (13.4) | | 51.7 (17.9) | | 52.9 (15.3) | | 43.5 (21.4) | | 48.8 (16.7) | |
| | | | | | | | | | | | |
| Provider group | Doctor | 63.1 (11.8) | | 67.9 (14.5) | | 61.9 (12.1) | | 60.7 (19.0) | | 58.9 (15.8) | |
| | Clinical Officer | 49.6 (11.8) | <0.001** | 50.0 (17.5) | 0.001** | 54.2 (14.5) | 0.076 | 45.3 (20.3) | 0.013* | 49.0 (17.3) | 0.058 |
| | Medical Assistant | 39.4 (9.9) | 0.001** | 44.6 (14.4) | 0.229 | 43.3 (14.8) | 0.006* | 27.0 (13.4) | <0.001** | 41.3 (11.5) | 0.069 |
| | | | | | | | | | | | |
| Facility type | Referral Facility | 51.0 (13.8) | | 52.1 (18.9) | | 54.1 (14.7) | | 47.6 (21.5) | | 50.0 (17.5) | |
| | Primary Facility | 43.4 (10.1) | 0.031* | 50.0 (13.6) | 0.656 | 48.8 (17.1) | 0.194 | 28.3 (12.5) | <0.001** | 44.4 (12.3) | 0.211 |
| | | | | | | | | | | | |
| Frequency of injury care | At least weekly | 51.4 (14.0) | | 54.5 (18.5) | | 53.7 (16.0) | | 45.6 (22.5) | | 50.2 (17.4) | |
| | Less than weekly | 45.9 (11.7) | 0.071 | 46.4 (15.7) | 0.045* | 51.5 (14.1) | 0.519 | 39.7 (19.0) | 0.222 | 46.2 (15.1) | 0.296 |
| | | | | | | | | | | | |
| Injury care training level | Post-qualification training | 52.0 (13.0) | | 53.1 (18.5) | | 53.0 (13.3) | | 52.7 (21.5) | | 48.3 (18.5) | |
| | No post-qualification training | 48.0 (13.6) | 0.186 | 51.0 (17.6) | 0.593 | 52.9 (16.4) | 0.992 | 38.5 (19.6) | 0.003** | 49.1 (15.7) | 0.843 |

Footnote: P values represent univariate comparisons. For provider group, p values are for Doctors vs Clinical Officers and Clinical Officers vs Medical Assistants

**Figure legends**

**Figure 1 Vignette scenarios in full.**
**Figure 2a - Scenario 1, acute management of a chest injured patient with tension pneumothorax**
**Figure 2b – Scenario 2, management of penetrating abdominal injured patient in shock**
**Figure 2c Scenario 3, management of patient with severe head injury**
**Figure 2d - Scenario 4, management of open lower leg fracture**

**Appendix Figure 1 – Histograms of total percentage score and for each scenario 1-4 across all participants.**
**Appendix Figure 2 – Percentage total score plotted against consecutive cases in facility with most clinicians participating.**

**Figure 1, Vignette scenarios in full.**

**Scenarios**

*1 - A middle-aged farmer was kicked in the chest by a cow about 2 hours ago. He complains of pain in his right chest and difficulty in breathing.*

*(Additional information) - The patient is breathing 30 breaths per minute with evidence of hypoxia. You discover that the patient has reduced breath sounds on the right side. The chest wall is not moving much on the right side. The trachea seems to be shifted to the left and there is increased resonance on percussion.*

*2 - A 20-year-old male is brought in by friends to the facility. They tell you he has been stabbed with a knife less than one hour ago. He has rapid shallow breathing, his radial pulse is fast over 110 beats per minute. He is complaining of pain in his abdomen.*

*(Additional information) - On examination you find only 1 stab wound in the anterior aspect of the lower right quadrant of the abdomen. The blood pressure is 85/60.*

*3 - A 19 year old girl was working on the roof of her home. She slipped and fell off hitting her head on the ground about 3 hours ago. She was initially behaving normally but then became confused and vomited several times. She started to become drowsy and so her family brought her to the facility by taxi.*

*(Additional information) - You find that she opens her eyes only when stimulated by pain and brushes your hand away when causing pain but does not obey your commands. She is using words but they don't make any sense. Her right pupil is 6mm in size and not reacting much to light. Her left pupil is 3mm and reacts normally to light. She has a swelling and bruise on the left side of her head.*

*4 - A 40-year-old motorcyclist was hit by a taxi on the main road 3 hours earlier. He is complaining of severe pain in his left lower leg. You examine his head, neck, chest, abdomen and pelvis and do not find any significant abnormality. His heart rate is 90 beats per minute. There is a wound with visible bone and obvious deformity suggesting fracture of his left lower leg.*

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## Appendices

### Appendix Table 1 - Generalised linear regression model for mean percent total score and each scenario mean score as dependent variable

| | | Total mean score | | | Scenario 1 mean score | | | Scenario 2 mean score | | | Scenario 3 mean score | | | Scenario 4 mean score | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | Parameter | Coefficient (95% CI) | P value | Estimated marginal means | Coefficient (95% CI) | P value | Estimated marginal means | Coefficient (95% CI) | P value | Estimated marginal means | Coefficient (95% CI) | P value | Estimated marginal means | Coefficient (95% CI) | P value | Estimated marginal means |
| Provider Group | Medical Assistant | Ref | | 40.2 | | | 44.7 | | | 41.8 | | | 32.7 | | | 40.1 |
| | Clinical Officer | 9.8 (2.8 - 16.8) | 0.006 | 50.0 | 7.5 (-2.5 – 17.5) | 0.141 | 52.2 | 13.8 (5.1 – 22.6) | 0.002 | 55.6 | 9.6 (-1.3 – 20.5) | 0.085 | 42.2 | 9.4 (6.2 – 31.6) | 0.061 | 49.4 |
| | Doctor | 23.8 (14.7 - 32.8) | <0.001 | 64.0 | 25.2 (12.2 – 38.1) | <0.001 | 69.8 | 22.0 (10.7 – 33.3) | <0.001 | 63.8 | 27.3 (13.2 – 41.4) | <0.001 | 60.0 | 18.9 (6.2 – 31.6) | 0.004 | 59.0 |
| Injury care training level | No postgraduate training | Ref | | 52.5 | | | 56.2 | | | 52.4 | | | 51.0 | | | 48.2 |
| | Any postgraduate injury care training | -2.2 (-7.5 - 3.0) | 0.402 | 50.3 | -1.3 (-8.8 – 6.2) | 0.737 | 54.9 | 2.8 (-3.7 – 9.4) | 0.401 | 55.2 | -12.1 (-20.2 – -3.9) | 0.004 | 38.9 | 2.7 (-4.7 – 10.0) | 0.479 | 50.8 |
| Frequency of injury care | Less than weekly | Ref | | 51.4 | | | 53.9 | | | 54.7 | | | 46.6 | | | 49.4 |
| | At least weekly | -0.1 (-5.4 - 5.2) | 0.975 | 51.3 | 3.2 (-4.4 – 10.9) | 0.405 | 57.2 | -1.8 (-8.4 – 4.9) | 0.596 | 52.9 | -3.4 (-11.7 – 4.9) | 0.428 | 43.3 | 0.1 (-7.4 – 7.6) | 0.976 | 49.6 |
| Facility type | Primary | Ref | | 51.8 | | | 58.9 | | | 55.4 | | | 39.9 | | | 50.2 |
| | Referral | -0.8 (-7.7 - 6.1 | 0.823 | 51.0 | -6.6 (-16.5 – 3.2) | 0.188 | 52.2 | -3.3 (-11.9 – 5.3) | 0.457 | 52.1 | 10.1 (-0.7 – 20.8) | 0.067 | 50.0 | -1.3 (-11.0 – 8.3) | 0.785 | 48.8 |

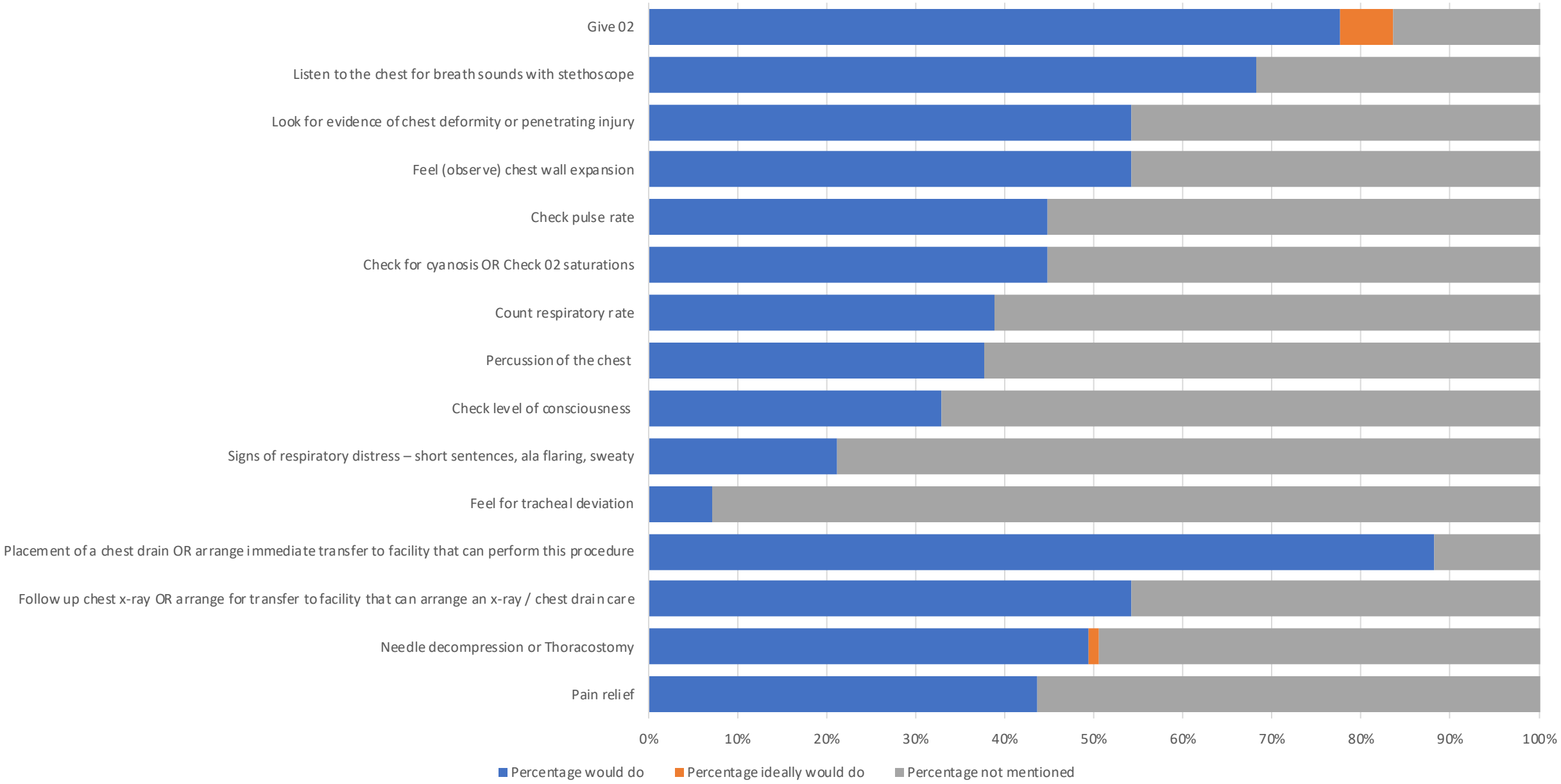
**Appendix Table 2 Reasons why certain aspects of care were not possible.**

| Scenario | Care aspect | Reason | Number of participants reporting |
|---|---|---|---|
| 1 | Give O2 | No Oxygen available | 4 |
| | | No accessories to administer | 1 |
| 1 | Needle decompression or Thoracostomy | Lacking equipment | 1 |
| 2 | Consider an investigation if available – FAST, CT, DPL | Not available locally | 7 |
| 2 | Consider a blood transfusion if needed | Not available locally | 3 |
| 2 | Check blood tests including Haemoglobin | Not available locally | 1 |
| 3 | CT scan OR Assessment by clinician able to operate on the skull OR transfer to hospital with neurosurgeon. | No CT available locally | 8 |
| 3 | Consider mannitol OR hypertonic saline | Not available locally | 3 |
| 3 | Avoid hypoxia | No Oxygen available | 1 |
| 3 | Consider need for intubation | Unable to intubate | 1 |
| | | Not available | 1 |
| 4 | X-ray | Not available locally | 8 |

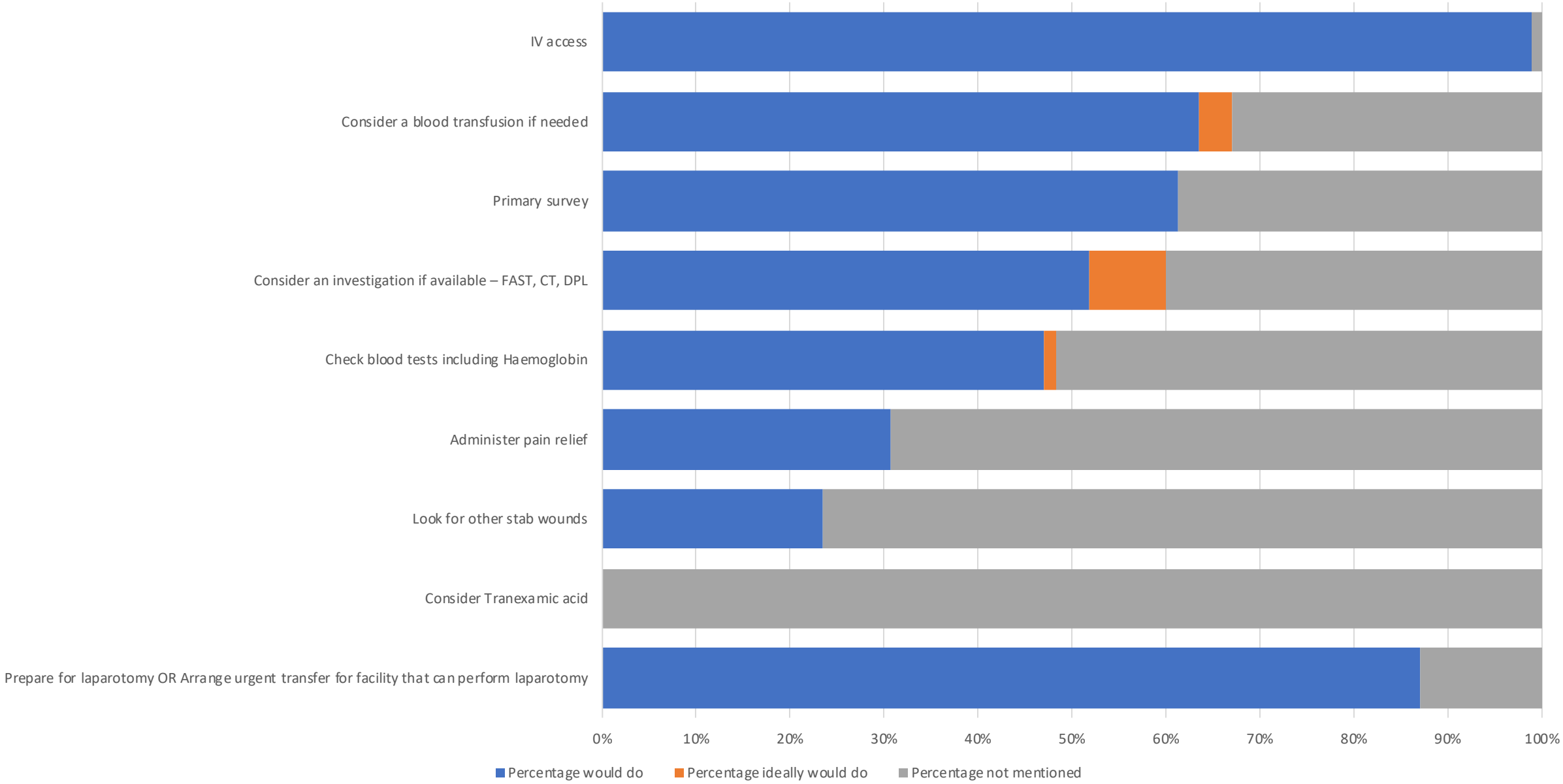
**Appendix Table 3 – Assessment of Skewness and kurtosis for scenario score outcomes**

| Descriptive Statistics | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Minimum | Maximum | Mean | Std. Deviation | Skewness | | Kurtosis | |
| | Statistic | Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic | Std. Error |
| percenttotalscore | 85 | 24.4 | 80.5 | 49.412 | 13.4497 | 0.296 | 0.261 | -0.551 | 0.517 |
| percent_scenario1 | 85 | 21.4 | 92.9 | 51.681 | 17.8621 | 0.123 | 0.261 | -0.747 | 0.517 |
| percent_scenario2 | 85 | 22.2 | 88.9 | 52.941 | 15.3009 | -0.095 | 0.261 | -0.865 | 0.517 |
| percent_scenario3 | 85 | 10 | 90 | 43.529 | 21.4202 | 0.375 | 0.261 | -0.71 | 0.517 |
| percent_scenario4 | 85 | 0 | 87.5 | 48.824 | 16.6619 | -0.225 | 0.261 | -0.123 | 0.517 |
| Valid N (listwise) | 85 | | | | | | | | |

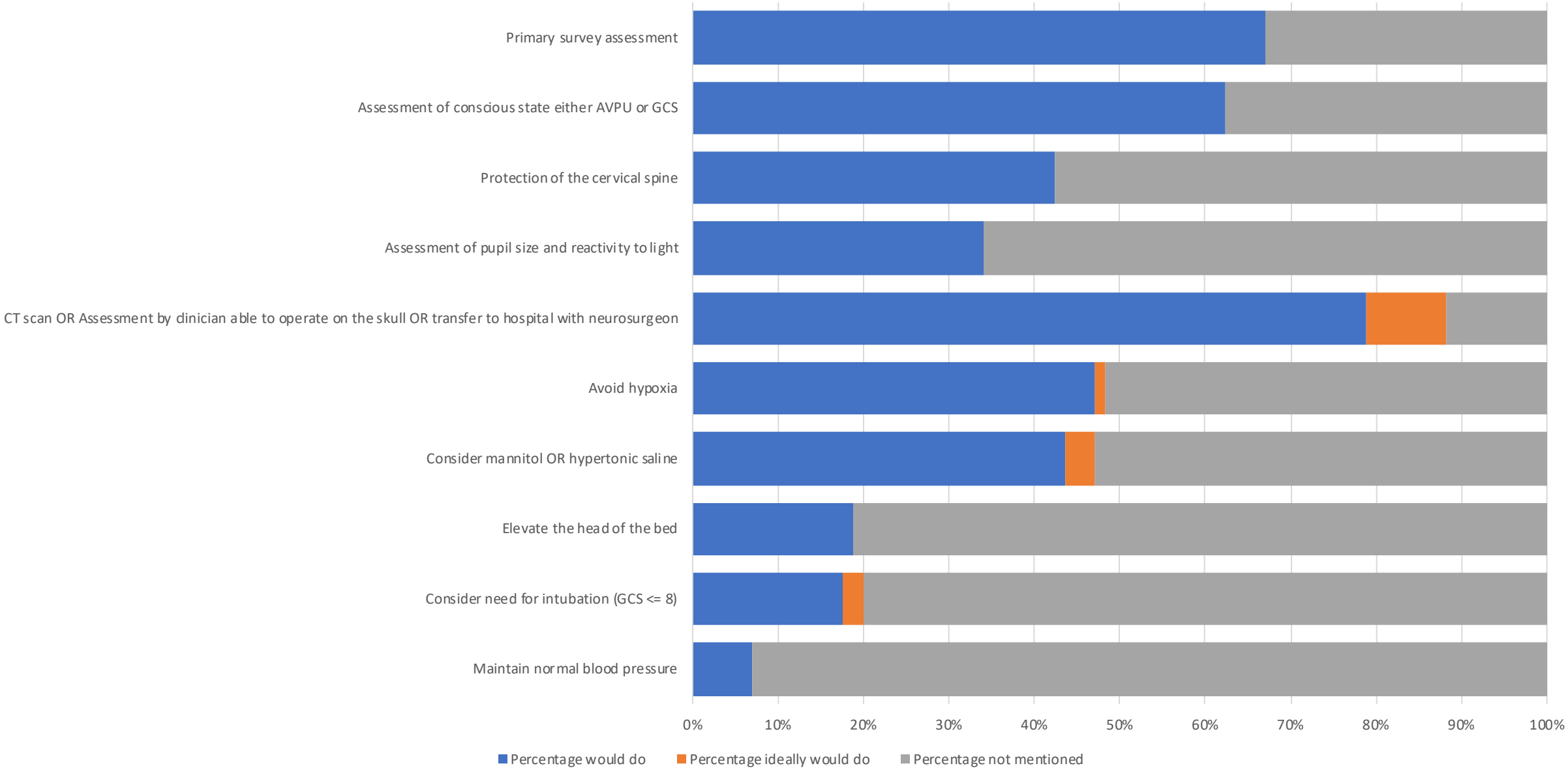
Figure 2a - Scenario 1, acute management of a chest injured patient with tension pneumothorax



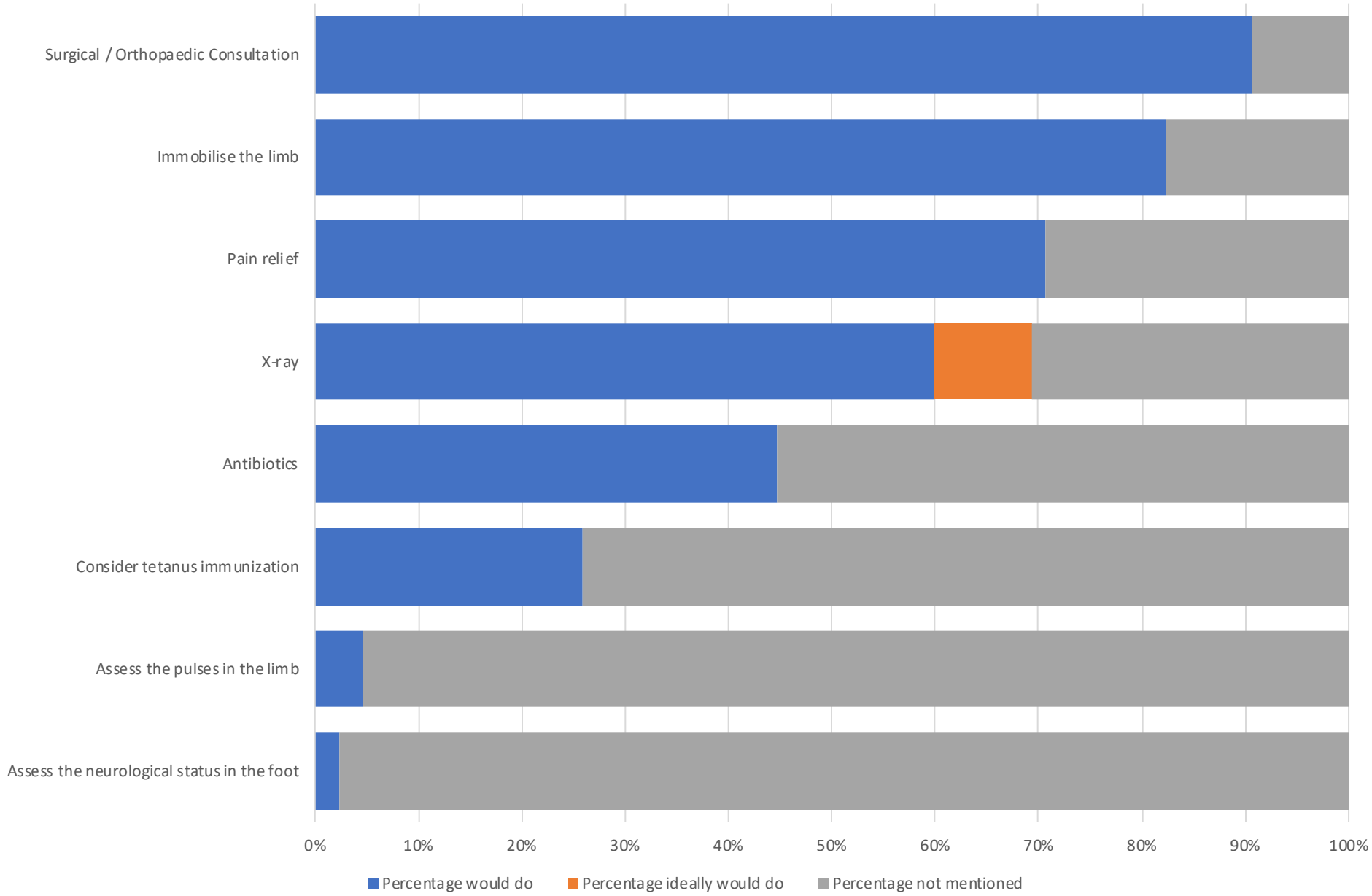
# Figure 2b – Scenario 2, management of penetrating abdominal injured patient in shock

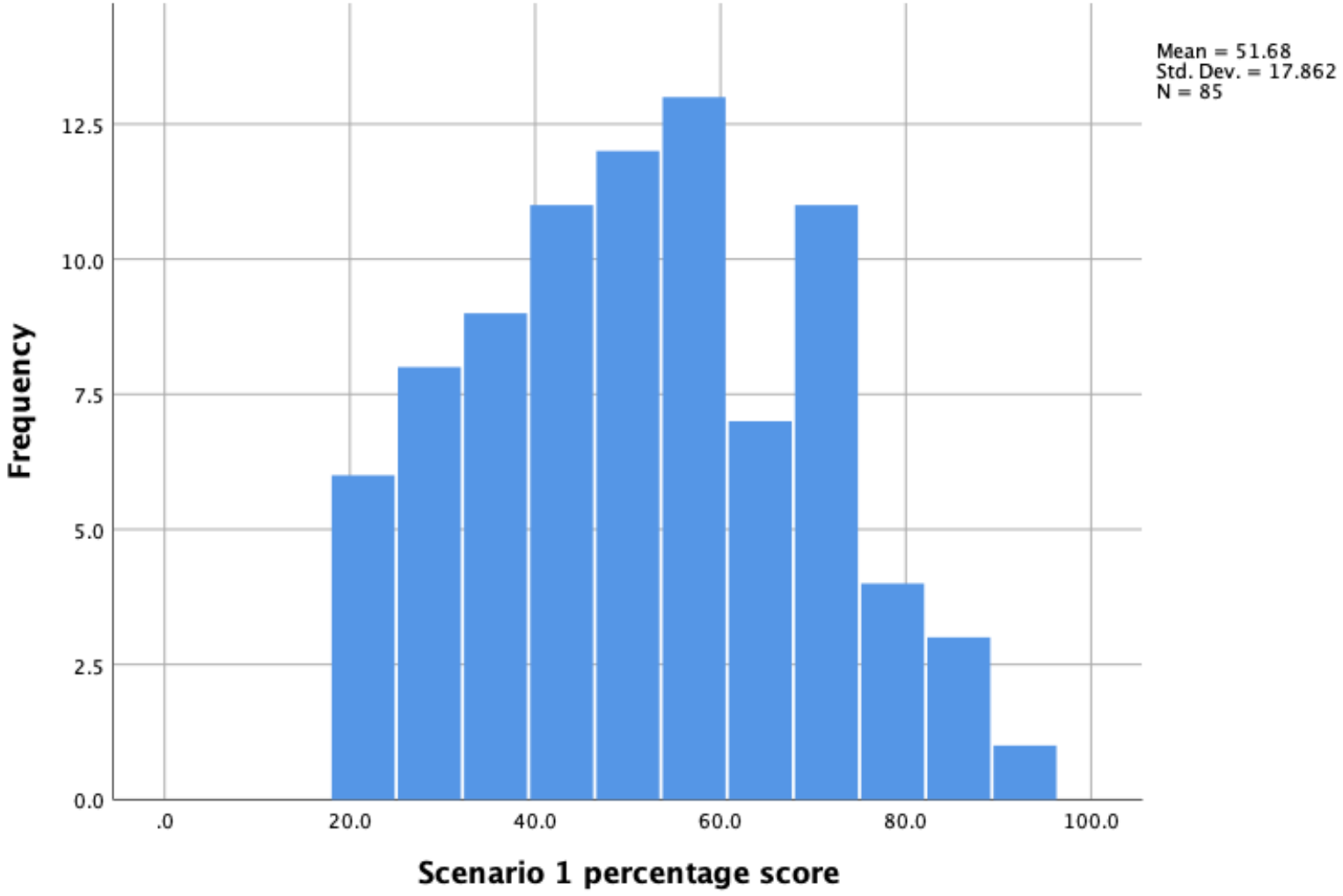


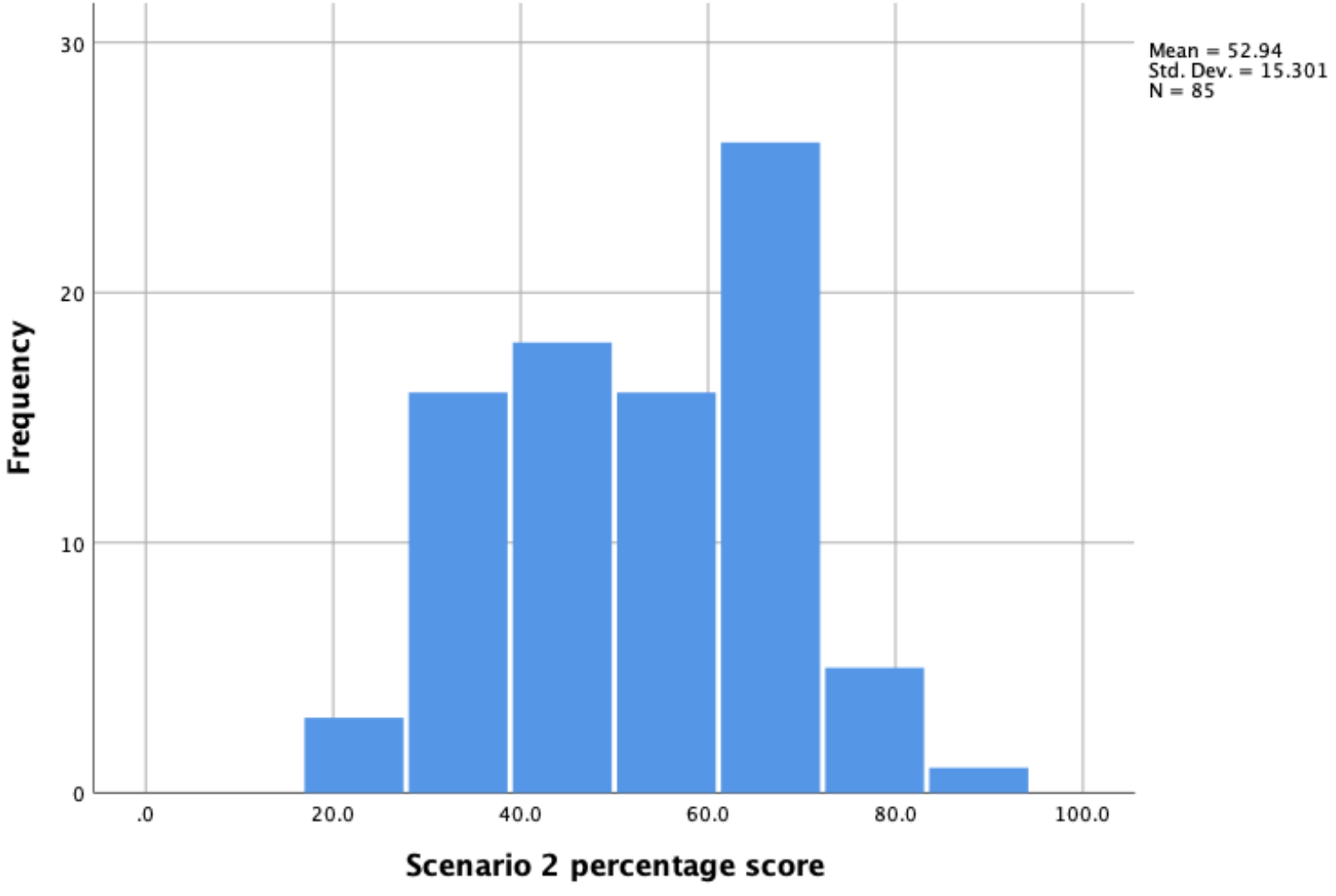
# Figure 2c - Scenario 3, management of patient with severe head injury

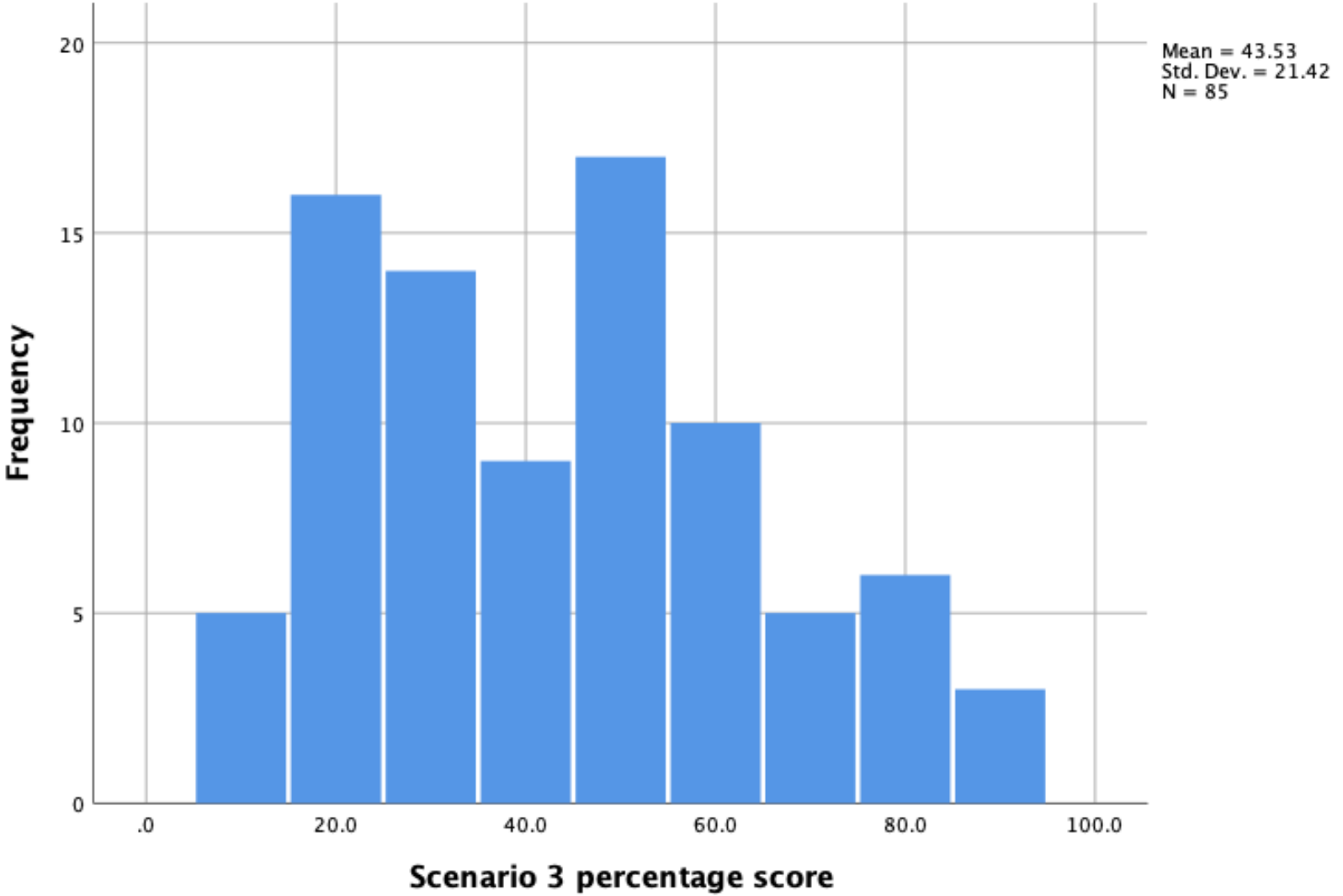


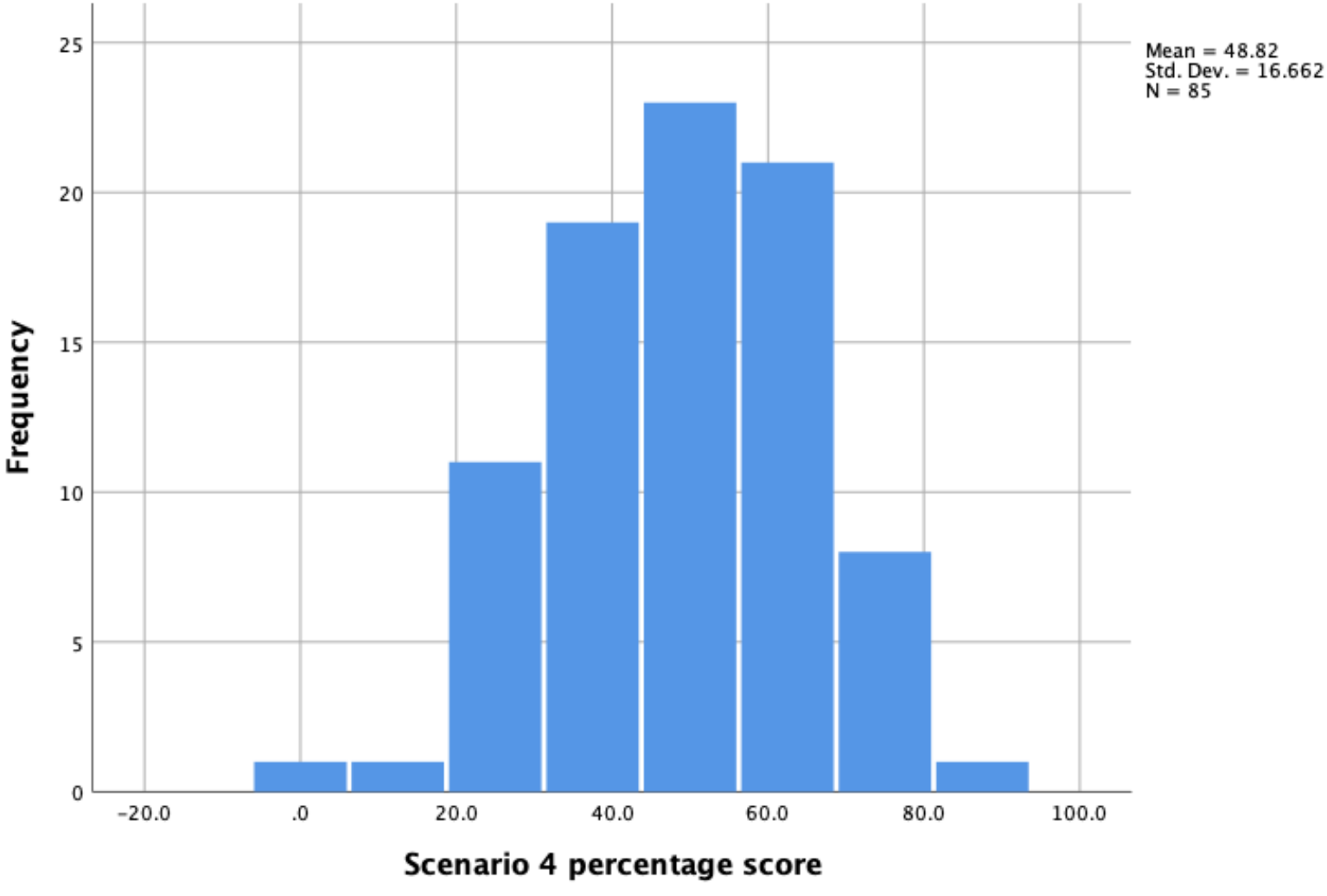
# Figure 2d - Scenario 4, management of open lower leg fracture

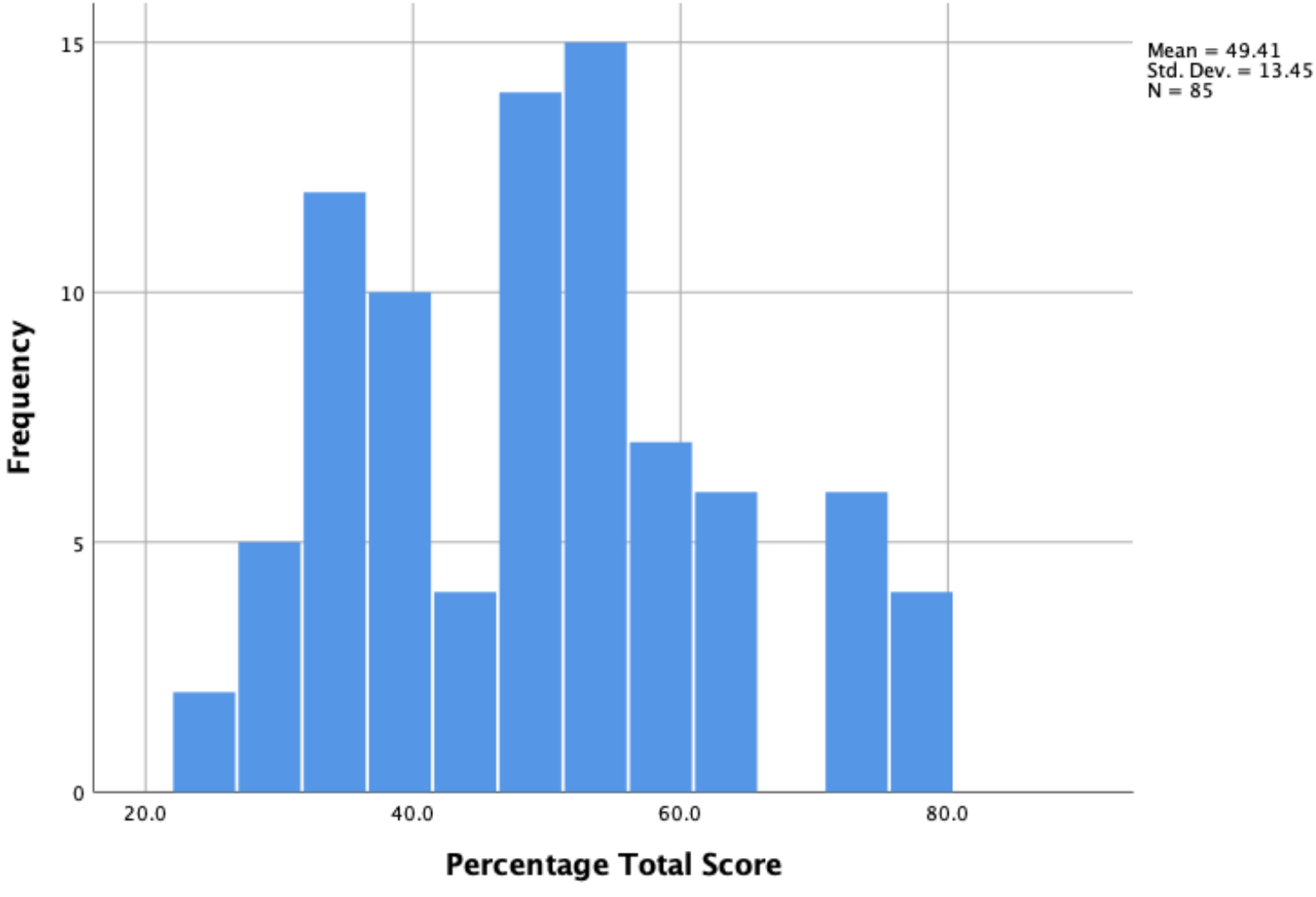


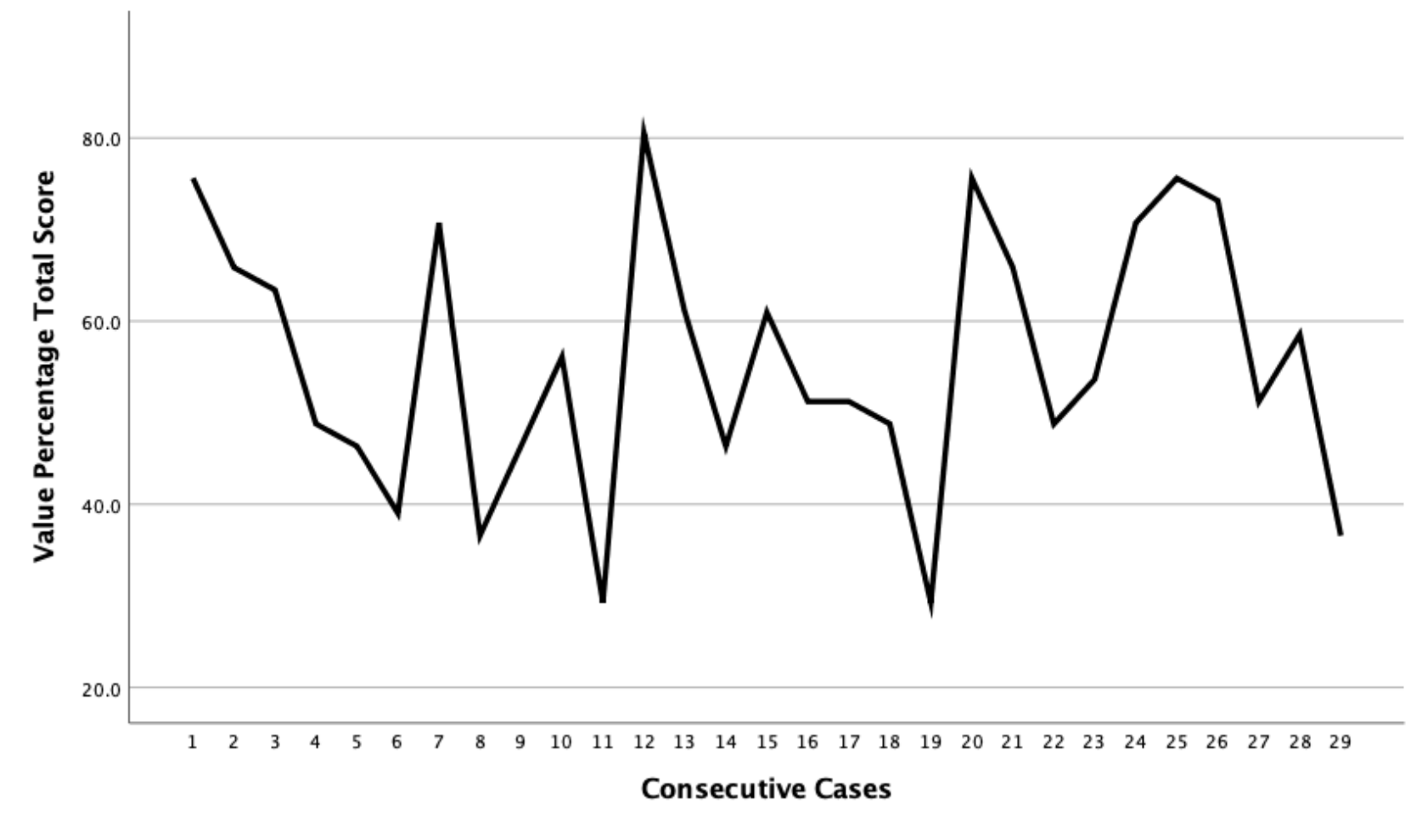

Mean = 51.68
Std. Dev. = 17.862
N = 85
Frequency
12.5
10.0
7.5
5.0
2.5
0.0
.0
20.0
40.0
60.0
80.0
100.0
Scenario 1 percentage score


Mean = 52.94
Std. Dev. = 15.301
N = 85
Frequency
30
20
10
0
.0
20.0
40.0
60.0
80.0
100.0
Scenario 2 percentage score


Mean = 43.53
Std. Dev. = 21.42
N = 85
Frequency
20
15
10
5
0
.0
20.0
40.0
60.0
80.0
100.0
Scenario 3 percentage score


Mean = 48.82
Std. Dev. = 16.662
N = 85
Frequency
25
20
15
10
5
0
-20.0
.0
20.0
40.0
60.0
80.0
100.0
Scenario 4 percentage score


Mean = 49.41
Std. Dev. = 13.45
N = 85
Frequency
15
10
5
0
20.0
40.0
60.0
80.0
Percentage Total Score


Value Percentage Total Score
80.0
60.0
40.0
20.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Consecutive Cases