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# The Simple Triage Scoring System (STSS) successfully predicts mortality and critical care resource utilisation in H1N1 pandemic flu: a retrospective analysis

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**The Simple Triage Scoring System (STSS) successfully predicts mortality and critical care resource utilisation in H1N1 pandemic flu: a retrospective analysis**

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**Abstract**

**Introduction:** Triage protocols are only initiated when it is apparent that resource deficits will occur across a broad geographical area despite efforts to expand or acquire additional capacity. Prior to the pandemic the UK department of health (DOH) recommended the use of a staged triage plan incorporating Sequential Organ Failure Assessment (SOFA) developed by the Ontario Ministry of Health to assist in the triage of critical care admissions and discharges during an influenza outbreak in the UK. There is data to suggest that had it been used in the recent H1N1 pandemic it may have led to inappropriate limitation of therapy if surge capacity had been overwhelmed.

**Methods:** We retrospectively reviewed the performance of the Simple Triage Scoring System (STSS) as an indicator of the utilisation of hospital resources in adult patients with confirmed H1N1 admitted to a university teaching hospital. Our aim was to compare it against the staged initial SOFA score process with regards to mortality, need for intensive care admission and requirement for mechanical ventilation and assess its validity.

**Results:** Over an 8 month period, 62 patients with confirmed H1N1 were admitted. 40 (65%) had documented comorbidities and 27 (44%) had pneumonic changes on their admission CXR. 19 (31%) were admitted to the intensive care unit where 5 (26%) required mechanical ventilation (MV). There were 3 deaths. The STSS group categorisation demonstrated a better discriminating accuracy in predicting critical care resource usage with a receiver operating characteristic area under the curve (95% confidence interval) for ICU admission of 0.88 (0.78-0.98) and need for MV of 0.91 (0.83-0.99). This compared to the staged SOFA score of 0.77 (0.65-0.89) and 0.87 (0.72-1.00) respectively. Low mortality rates limited analysis on survival predictions.

**Conclusions:** The STSS accurately risk stratified patients in this cohort according to their risk of death; predicted the likelihood of admission to critical care and the requirement for MV. Its single point in time, accuracy and easily collected component variables commend it as an alternative reproducible system to facilitate the triage and treatment of patients in any future influenza pandemic.

## Introduction

The word triage originates from the French ‘trier’ (to choose from among several) and was originally applied as a process of sorting wounded soldiers around 1792, by Baron Dominique Jean Larrey, Surgeon in Chief to Napoleon’s Imperial Guard, Its aim was to optimise the use of available medical resources to maximise efficacy [1]. Patients with the greatest chance of survival with the least resource use are treated first [2]. In disaster situations the focus of medical care is directed towards the needs of the community. Allowing for this approach, it is clear that the standard of care for all patients, including those not directly related to the incident, may need to be adjusted and reduced. While this may infringe individual rights, the higher ethical principle of 'wellness of society as a whole' allows for the direction of resources to those where it is felt to be most effective.

An influenza pandemic had been expected for a number of years. Preparing for such an event led to the need to examine how different health care systems across the world could respond to such an event which may require a large surge in the need for critical care capacity. On 11 June 2009 the World Health Organization declared the 1st influenza pandemic since 1968. Emerging from a triple-reasortant virus circulating in North American swine [3], the new influenza A virus variant, H1N1 has affected more than 213 countries and territories worldwide [4]. Epidemiological models assumed the peak demand for critical care resources would significantly outstrip supply [5]. The pandemic declaration brought into sharp focus the strategic planning that the International community had been developing since the outbreak of avian flu H5N1 in 2005 [6]. Surge capacity planning identified the need for a consistent, objective triage system based on physiological scores that was valid, reproducible and transparent given the likelihood of a need to ration critical care resources [4].

The UK DOH recommended a system devised by a panel of experts commissioned by the Ontario ministry of health. This system was proposed to guide '*critical care resource allocation issues'* during the initial days and weeks of an overwhelming influenza pandemic and to prioritise admission to critical care beds. After an exhaustive literature search the Sequential Organ Failure Assessment (SOFA) score [7] was suggested as part of a staged triage and treatment prioritisation tool to be used in association with a number of inclusion and exclusion criteria based upon co-morbidities and estimated prognosis [8,9]

The SOFA score has been shown to reliably evaluate and quantify the degree of organ dysfunction present on admission to ICU (*initial score*) or developing during ICU stay (*delta score* - subsequent total maximum SOFA scores minus admission total SOFA). The *maximum SOFA score* reflects cumulative organ dysfunction that develops and correlates with mortality, while the *mean* score is a good prognostic indicator predicting outcome throughout an ICU stay [10,11].

The Ontario working group's proposal to aid mass triage had no information on the epidemiology or pathophysiology regarding the virus that would cause the pandemic. The clinical course of H1N1 pandemic influenza has not occurred as expected. As data has become accessible reports suggest that SOFA may not be a good discriminator of outcome in this cohort of patients [12,13]. Thus, it's suitability as a means to assist in the triage of H1N1 patients has been called into question.

The Simple Triage Scoring System (STSS) Table 1 which utilises only those vital signs and patient characteristics that are readily available at initial presentation was proposed as a potential alternative tool in predicting death and the utilisation of critical care resources during epidemics by Talmor et al in 2007 [14]. Its components consist of age, shock index (heart rate>blood pressure), respiratory rate, oxygen saturation and altered mental state. In a multi-centre retrospective analysis of prospectively collected data the STSS score variables were validated in 2 cohorts of patients (n=1927) presenting with sepsis to 2 separate emergency departments. The score was found to be predictive of the need for admission to ICU and the requirement for mechanical ventilation (MV) in addition to the primary outcome of mortality.

Our objective was to review the performance of the admission STSS and SOFA scoring systems as indicators to the utilisation of hospital resources and mortality in patients with H1N1 infection admitted to a UK university teaching hospital.

## Materials and methods

In a service evaluation assessment we retrospectively reviewed the notes of all adult patients admitted to the hospital and subsequently confirmed to have contracted H1N1 between July 2009 and February 2010. The study was conducted under the auspices of the Southampton University Hospital Trust Critical Care Department. Pertinent demographic data, comorbidity, initial CXR findings, mode of ventilatory support, level of care, bed days, mortality and the physiological and laboratory components required to calculate the STSS and SOFA scores *at the point of hospital admission* were collected. Where an arterial blood gas result was not available to calculate the respiratory component of the SOFA score, the validated SpO2/FiO2 (S/F) ratios correlations derived by Pandharipande et al were utilised [15]. Our institutions pandemic flu protocol called for the involvement of critical care in any patient whose FiO2 requirements exceeded 60% to maintain a PaO2 of >8kPa.

The discriminatory power of the individual score groupings were calculated and analysed to assess their performance in the initial triage of the H1N1 patient with reference to mortality (primary outcome), the need for ICU and need for mechanical ventilation (secondary outcomes).

## Statistics

The accuracy of each score in predicting outcome was assessed by plotting the receiver operating characteristic (ROC) curve and calculating the area under the ROC curve (AUC) with 95% Confidence intervals. [16]. The AUC values were ‘ranked’ as excellent (AUC≥0.90), good (AUC≥0.80 and <0.90), fair (AUC≥0.70 and <0.80) and poor (<0.70). (SPSS, IBM, Chicago).

## Results

62 adult patients (35 male) were admitted to our hospital from either the medical assessment unit or emergency department with a polymerase chain reaction confirmed diagnosis of H1N1. Their mean age (range) was 41 (18-71) years Table 2. 40 (65%) had either single (32) or two (8) co morbidities documented (25 respiratory), 3 were morbidly obese and 3 pregnant. 27 (44%) had either a secondary broncho or lobar pneumonia reported and formally confirmed by a consultant radiologist on their admission CXR. 19 (31%) were admitted to the intensive care unit where three required only supplementary oxygen, 11 (58%) were managed with non-invasive ventilation (NIV) and 5 (26%) required intubation and mechanical ventilation.

There were 3 deaths, all with pneumonic features on their admission CXRs, 2 were invasively ventilated. Of the 2 male patients with STSS score of 2, one had COPD and one had COPD and biventricular failure. The latter patient had been treated for H1N1 a week previously, discharged home and represented with a secondary bacterial chest infection and associated sepsis. He was still H1N1 positive at this time. He suffered an MI and went into multiple organ failure. The patient with an STSS score ≥ 3 was an 18 year old female with no comorbidities presented after being symptomatic for 5 days with bilateral bronchopneumonic changes on her CXR and died from complications of extracorporeal membrane oxygenation (ECMO) at the national ECMO centre.

The median time from presentation to admission to ICU for 16 out of 19 (84%) patients was <24 hours (range: 0-2 days). Of the 3 remaining patients, 2 were admitted to ICU after 24 hours as in-patients and 1 48 hours after hospital admission with STSS scores of 2 and SOFA scores of 3,5 and 1 respectively. This latter patient did not survive. The median (range) number of level 2 and level 3 critical care bed days used for H1N1 patients over the study period were 4 (2-23) and 23 (1-46) days respectively.

A comparison of the STSS and SOFA score categorisation shows a reasonable agreement regarding the severity of the patient's illness Figure 1. The admission STSS Table 3 and initial SOFA scores Table 4 were calculated and compared against actual mortality, need for ICU admission and need for mechanical ventilation. The performance of STSS and SOFA in our subset are compared to the figures quoted in the original reports [9,13] where the ROC area under the curve results were used to assess the performance of the individual score groupings.

Due to the low H1N1 related mortality rate in our cohort, analysis of this outcome data was not possible. However, the trends suggest a higher STSS score equates to higher mortality than a high SOFA score. The SOFA score performed well in predicting the need for admission to the ICU, ROC AUC 0.77 (0.65-0.89) and the requirement for MV, ROC AUC 0.87 (0.72-1.00). Nonetheless the performance of the STSS score was better at predicting need for ICU admission, ROC AUC 0.88(0.78-0.98) and need for MV 0.91 (0.83-0.99) Figure 2.

Applying the exclusion criteria within the staged triage protocol incorporating SOFA developed by Ontario as recommended by UK DOH, a total of 5 patients would have been excluded from ICU admission (SOFA score >11, CLL (post allogenic transplant), Lymphoma (post allogenic transplant), cervical cancer, cystic fibrosis). All these patients survived this hospital admission to discharge.

## Discussion

During a mass casualty event, the triage of patients to determine those who may require, do require and are receiving definitive critical care interventions needs continuous re-evaluation to impartially allocate the limited resources. Once surge capacity has reached its limit the delivery of critical care moves to the 'process of last resort', that is triage [17]. Ideally the selected prioritisation tool needs to not only be able to facilitate tertiary critical care triage (the allocation of mechanical ventilators) [18] but also be applied in the community assisting GPs in deciding which patients should be referred into hospital and assisting hospital physicians as to whether referral to ICU is appropriate [19].

Recently, there has been great effort to set out these prerequisite basic concepts and assumptions to cope with critical care resource allocation with much reference to military experience. Standard operating procedures describing the rationale, components, implementation and frame work to guide and support the development of local and national protocols, particularly with regards to mass infection, have been published [20-22].

A decision matrix where the weight of objective prognostic information supersedes any subjective or individual patient factors may be an uncomfortable paradigm of deliberation for the physician. Therefore to ensure justice to both the physician and to the patient there has to be institutional oversight and 'guidelines'. A triage plan will equitably provide every person the opportunity to survive, but it cannot guarantee either treatment or survival [8]. However, such a plan cannot supersede the judgement of a physician faced with the triage situation as it is only upon retrospective analysis of the true outcomes of individual patients compared to their predicted outcomes and triaged status that an evaluation of the appropriateness and justice of the triage decision can be made [2].

The SOFA score was originally designed to describe the morbidity ensuing from organ dysfunction in critically ill patients over the course of their ICU stay. The maximum SOFA score as well as the delta SOFA have been shown to be good instruments in the evaluation and quantification of the degree of organ dysfunction/failure present on admission to the intensive care unit (ICU) [11]. Ferreira et al [10] evaluated the initial, mean, highest, and delta SOFA scores in a cohort of 352 patients admitted to their ICU in Belgium. Scores were then correlated with mortality. They showed that an initial SOFA score up to 9 predicted a mortality of < 33% while a score >11 predicted a mortality of 95%. When the initial score was 8-11, an unchanged or increasing score was associated with a mortality rate of 60% (initial score 2-7, mortality 37%). Therefore a positive delta SOFA score during the first 48 hours of an ICU admission predicted a mortality of at least 50%.

The Ontario protocol, as in the military, advocated the application of a colour coded prioritisation tool. Reassessment would occur at specified time periods (~ 48 and 120 hours) by a member of the triage team. Patients not meeting the inclusion criteria at reassessment or deteriorating and not expected to survive are transferred to the ward for ongoing care or palliation respectively. This re-evaluation would also be applied to ward based patients that deteriorate or improve. The 'cut off' would be the presentation with or development of a SOFA score of >11 [20,19,2,8,22].

Predictive validity considers the degree to which the triage acuity level predicts true acuity. The primary problem with predictive scoring systems is that they are population specific, derived and validated on specific cohorts of patients and thus their ability to predict the outcome of an individual are poor [23]. Therefore, the decision to reassign a mechanical ventilator from one patient to another would be difficult to justify unless a large difference in the (~ 25%) [22] survival advantage predicted by the scoring system was demonstrated. Critical care scoring systems have not been designed for this purpose.

In this study we assessed the performance of an alternative scoring system: the STSS in H1N1 patients admitted to a UK teaching hospital. We compared this to the initial SOFA score as the organ dysfunction measure within a triage prioritisation tool. To our knowledge the performance of STSS has not been tested on patients during a pandemic. Although the STSS was developed on a cohort of individuals presenting with a variety of infectious diseases to an ED it was recommended for use during a pandemic. It is simple and can be carried out by a wide range of health care staff in a variety of settings. Importantly the STSS score excludes both the patient's history (which may not be available at the point of entrance into the medical system) and laboratory testing which adds time delay to triage. SOFA incorporation of the latter would result in delay in decision making and consumption of stretched laboratory resources. Additionally, whereas the variability in the subjective assessment of the GCS component in the SOFA may affect its inter-observer accuracy, the binary nature of the comparison measure in the STSS of 'altered mental state' may ameliorate this source of error. In our cohort of patients STSS performed well; risk stratifying patients with this viral illness with regards to need for admission to the intensive care and need for MV.

The clinical nature of any pandemic only becomes apparent as the event unfolds. The mortality of H1N1 has fortunately been considerably less than that seen with H5N1. It is widely reported that the clinical attack rate and most severe disease has been highest in the young [24]. The Australasian and Canadian experiences of the 2009 pandemic demonstrated how population differences present in different communities can confound the application of 'evidence' across these disparate populations. Kumar reported 43/168 (25.6%) of critically ill flu patients in Canada over the period described were Inuit who represent just 3.75% of the population. Similarly the ANZIC investigators reported the Aboriginals' (2.5% of the population) represented 9.7% of the ICU admissions in Australia and the Maoris (13.6% of the population) emerged as 25% of the critically ill in New Zealand [25,26]. The pattern of illness was markedly different in our population. Without a native indigenous population that may have lacked exposure to previous H1N1 epidemics and in the context of freely available antivirals and later specific pandemic vaccine, we were fortunate to suffer only three deaths in our study population. In addition a large number of our almost entirely European caucasian patients benefited from the application of NIV – this was not seen in either Canada or Australasia Our low mortality rate prevented assessment of the STSS scores' discriminatory potential with regards to H1N1 in this regard.

Despite the fact the STSS scale has only four points, as opposed to a maximum of 24 on the SOFA scale, in this study the STSS discriminated between outcomes equally well, and crude data analysis suggests that it may be better. The ROC areas for the STSS score related to both secondary outcomes of ICU admission and need for MV demonstrated both higher values and better fit than the SOFA score values despite our small sample size.

Though the Ontario staged triage protocol has not been evaluated as a predictor of health care resource usage our study suggests that the SOFA's utility in this respect was fair for ICU admission (AUC 0.77) and good for MV (AUC 0.87). Part of the Ontario's recommended remit was to "identify at an early stage those patients not responding to treatment and therefore likely to have a poor outcome…once treatment and care start…by formal periodic assessments to determine whether…they are not responding to treatment or are deteriorating despite treatment, and so further treatment should be withheld in favour of symptom relief" [19]. Ferreira et al [10] note that length of stay (LOS) was not related to outcome prediction when using SOFA and that the mean SOFA score had a better prognostic value than the other SOFA derived variables i.e. patients who presented with a limited degree of organ dysfunction and had a long stay could still have a high likelihood of survival.

A reduction in SOFA in the first 48 hours was associated with a 23% risk of death and LOS 10.9 days. However, Khan et al [12] showed 63% survival in the SOFA defined poor prognosis group in H1N1 with a LOS of 11 (3-17) (mean (range)) days. This presents a problem if we assume part of DOH intended application of the triage tool was to limit those 12.4 days by early palliation. If we also apply this risk of death following delta SOFA reduction (23%) to Khan's risk of death with delta SOFA increase - 37%; this significantly narrows the difference in risk between those that would possibly die or possibly survive (14%). Hick et al [22] paper suggests that this level of difference would not be enough to confidently re-allocate ventilator resources.

The SOFA score was designed for ICU admission, the STSS system for hospital admission. Their use as the organ dysfunction component within a triage prioritisation tool designed for use at all levels of health care delivery from community to critical care obviates any concerns about the difference between secondary and tertiary triage measures. 84% of the patients were transferred to ICU <24 hours after their admission and we would therefore have expected equivalence or better performance from the SOFA score. The 3 patients that had their scores calculated at a time distant from their admission to the ICU had SOFA scores ranging from 1-5 and STSS scores of 2 with the patient with the SOFA score of 1, admitted to the ICU after 2 days as an in-patient not surviving. This was a gentleman readmitted to hospital with pneumonia after being discharged home, but still H1N1 positive, who died of multi organ failure.

We would submit that these factors suggest that the STSS performs better in this population and overall would be a more appropriate early assessment triage rule. Given the heterogeneity of possible events causing a mass casualty episode, no single tool can be expected to provide adequate decision-making power. Due to the potential uncertainty arising from each individual patient's physiological response to treatment, scoring systems must be tempered by clinical decision making and viewed as indicators to assist clinical assessments and not as definitive triaging values. Due to the unpredictable nature of any new strain of a pandemic virus many authorities call for continuous revalidation and refinement of any triage model and it's scoring systems at the point of outbreak and throughout all its phases and thereby determine their suitability and discriminating power for use as triage prioritisation tools at a multi-centre/national level [19,8,18].

It is clear that in the absence of a thoughtful approach to triage, critical care resources would be depleted within the first weeks of a pandemic. Such triage tools will also require a staged approach which needs to start with the patient in the community and triage in a step wise manner those who ultimately will require maximum care in a critical care unit. The STSS score is designed to be used at the front door of the hospital and may be of value in indicating patients who will require high resource utilisation. In our small cohort it appeared to perform as well if not better than the SOFA score in identifying those who needed ICU care. The focus at the hospital level would be on establishing the process that will be followed at the health care facility. This is crucial because regardless of the origin of the decision tool the implementation of the tool occurs at the hospital level [22]. Therefore adequate workforce knowledge and training regarding the underpinning principles of any prioritisation tool is required to overcome medical staffs' natural reluctance to 'ration' their care delivery [27].

Our study is limited by its retrospective nature, size and number of significant events. The STSS scores performance in 'all comers' to the ED and specifically to the ICU, as well as over the time course of each individual admission was not assessed raising concerns about its validity in other critically ill patients. However, it should be remembered the SOFA score was also initially developed as a sepsis related score in 1996 [7]. What our study highlights is that mandating a particular scoring system may not be the best approach. Perhaps considering different tools in the early phase including perhaps one employing a disease specific scoring system and quickly assessing their utility, maybe the most pragmatic approach until the clinical course and pathophysiology of the particular influenza variant becomes apparent -

**Conclusions**

In summary, despite being underpowered due to a small sample size, number of deaths and percentage of those mechanical ventilated, it would appear that the four groupings of the STSS score 'accurately' risk stratify patients in this cohort according to their risk of death and predict the likelihood of admission to critical care and the requirement for mechanical ventilation in line with the derivation population. Its single point in time accuracy and easily collected component variables, commend it as an alternative reproducible system to facilitate the triage and treatment of patients in any future influenza pandemic. Further analysis should include a prospective evaluation of its validity as a staged protocol in a larger cohort of unselected unwell patients presenting to the ED as an assessment of its morbidity and mortality prediction in different populations once they have been admitted to the ICU.

**Key messages**

- The easier to calculate STSS score accurately predicts critical care resource usage (admission to ICU and requirement for mechanical ventilation) in H1N1 with initial hospital presentation parameters.
- Further analysis of the STSS score as a predictor of mortality in this cohort of patients should be investigated.
- The STSS score should be considered as an alternative triage tool in future epidemics.

**Abbreviations**

DOH, Department of Health; SOFA, Staged Sequential Organ Failure Assessment Score; STSS, Simple Triage Scoring System; MV, Mechanical

Ventilation; ROC, Receiver Operating Characteristic Curve; AUC, Area Under the Curve; NIV, Non-invasive Ventilation; ECMO, Extracorporeal Membrane Oxygenation; ICU, Intensive Care Unit; LOS, Length of Stay.

## Competing interests

The authors declare no competing interests.

## Author's contributions

All authors participated in formulation and design of this study. KA and BC performed the literature search and abstracted the data. KA wrote the first draft of the manuscript, which was then revised BC. All authors read and approved the final manuscript.

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**Tables**

**Table 1: The Simple Triage Scoring System**

| Variable | Odds Ratio | 95% Confidence Interval | Complex Rule points | Simplified (Final) Rule Points |
|---|---|---|---|---|
| **Respiratory rate >30 breaths/min** | 3.9 | 2.5 - 6.3 | 4 | 1 |
| **Shock index >1 (HR > BP)** | 2.8 | 1.8 – 4.2 | 3 | 1 |
| **Low oxygen saturation** | 2.8 | 1.8 – 4.2 | 3 | 1 |
| **Altered mental status** | 1.9 | 1.3 – 2.8 | 2 | 1 |
| **Age 65 -74 yrs** | 3.0 | 1.7 – 5.5 | 3 | 1 |
| **Age of ≥75 yrs** | 4.4 | 2.7 – 7.2 | 4 | 1 |

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HR, heart rate; BP, blood pressure.

**Table 2: Clinical characteristics of H1N1 patients admitted to hospital**

| Patient Characteristics (N=62) | Ward Based (N=43) | ICU Admissions (N=19) |
|---|---|---|
| **Age:** Years - median (range) | 35 (19-71) | 53 (18-71) |
| **Sex:** | | |
| Male | 26 | 9 |
| Female | 17 | 10 |
| **Comorbidity:** | | |
| 1 | 20 | 12 |
| 2 | 3 | 5 |
| ≥3 | 0 | 0 |
| **Obese** | 0 | 3 |
| **Pregnant** | 3 | 0 |
| **Abnormal CXR on admission:** | | |
| Bronchopneumonia | 10 | 9 |
| Lobar Pneumonia | 4 | 3 |
| Pulmonary Oedema | 0 | 1 |
| **Mode of Ventilation:** NIV / MV | 0/0 | 11 / 5 |
| **Hospital Outcomes:** | | |

| | | |
|---|---|---|
| Bed Days: median (range) | 4 (0-13) | 7 (1-46) |
| Mortality | 0 | 3* |

ED, emergency department; COPD, chronic obstructive pulmonary disease; CXR, chest X-ray; ICU, intensive care unit; NIV, non-invasive ventilation; MV, mechanical ventilation. (* 1 patient was transferred from ICU to the ward for palliation).

**Table 3: Discrimination of the STSS score groupings in predicting death, admission to ICU and need for Mechanical Ventilation (MV) in our study population (n=62) compared to the derivation population (n=3906) (*Talmor et al [14])**

| STSS Score | Mortality (%) | | Need for ICU (%) | | | Need for MV (%) | |
|---|---|---|---|---|---|---|---|
| | Derivation Group * N=3206 | Study Group N=62 | Derivation Group * | Study Group | Study Bed Days Median (range) | Derivation Group* | Study Group |
| **0** | 5/1144 (0.4) | 0/19 (0) | 61/1144 (5.3) | 1/19 (5.3) | 4 | 18/1144 (1.6) | 0/19 (0) |
| **1** | 45/1257 (3.6) | 0/21 (0) | 124/1257 (9.9) | 2/21 (9.5) | 3 (2-4) | 37/1257 (2.9) | 0/21 (0) |
| **2** | 54/617 (8.8) | 2/13 (15.3) | 140/617 (23) | 7/13 (53.8) | 9 (2-46) | 43/617 (7) | 1/13 (7.7) |
| **≥ 3** | 47/188 (25) | 1/9 (11.1) | 68/188 (36) | 8/9 (88.8) | 8 (3-24) | 25/188 (13) | 4/9 (44.4) |
| **ROC AUC (95% CI)** | 0.8 | Sample too small | 0.7 | 0.88 (0.78-0.98)[a] | - | 0.69 | 0.91 (0.83-0.99)[a] |

ROC, Receiver Operating Characteristic Curves; AUC, area under curve ([a]Fig2 – ROC curves for STSS vs. ICU & STSS vs. MV).

**Table 4: Discrimination of initial SOFA score groupings in predicting mortality in our study population (n=62) compared to the figures (n=352) quoted in * Ferreira et al [10]**

| Initial SOFA Score | Mortality (%) | | Need for ICU (%) | | Need for MV (%) |
|---|---|---|---|---|---|
| | Derivation Group * N=352 | Study Group N=62 | Study Group | Study Bed Days Median (range) | Study Group |
| **0-1** | 0/43 (0) | 1/21 (4.8) | 2/21 (9.5) | 10.5 (4-17) | 0/21 (0) |
| **2-3** | 5/77 (6.5) | 1/25 (4) | 9/25 (36) | 4 (2-23) | 2/25 (8) |
| **4-5** | 18/89 (20.2) | 0/10 (0) | 2/10 (20) | 15 (8-22) | 0/10 (0) |
| **6-7** | 14/65 (21.5) | 1/5 (20) | 5/5 (100) | 4 (1-46) | 2/5 (40) |
| **8-9** | 11/33 (33.3) | 0/0 (0) | 0/0 (0) | 0 | 0/0 (0) |
| **10-11** | 12/24 (50) | 0/0 (0) | 0/0 (0) | 0 | 0/0 (0) |
| **>11** | 20/21 (95.2) | 0/1 (0) | 1/1 (100) | 24 | 1/1 (100) |
| **ROC AUC** | 0.79 | Sample too small | 0.77 (0.65-0.89)[a] | - | 0.87 (0.72-1.00)[a] |
| **>11 and Exclusion Criteria** | 20/21 (95.2) | 0/5 (0) | 3/5 (60) | - | 2/5 (40) |

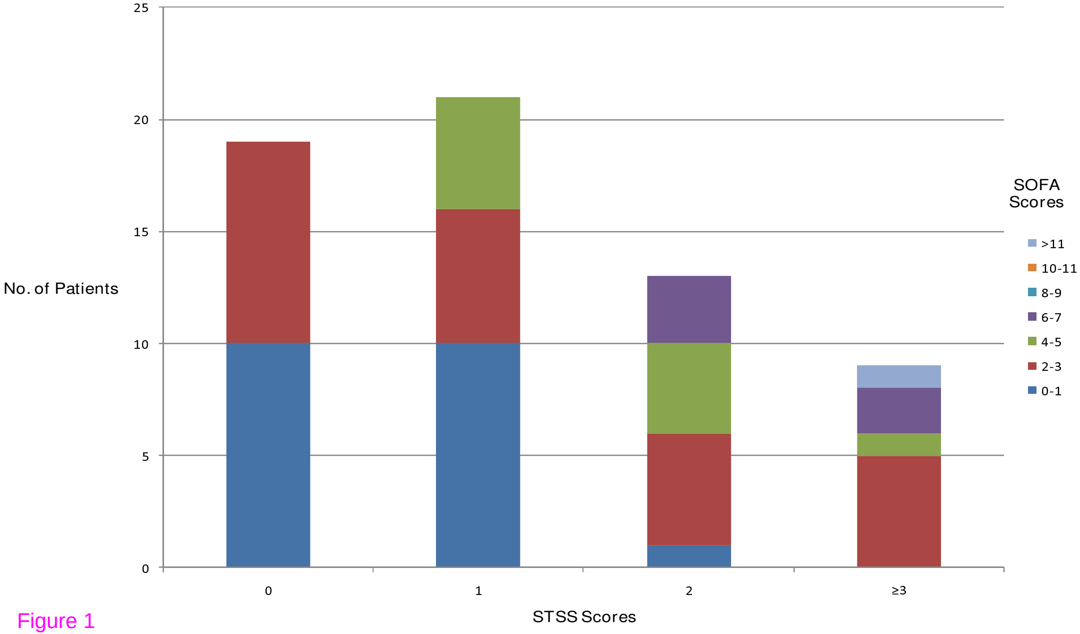
Assessment as to whether SOFA score had some functionality in predicting need for ICU and need for MV in our study group.

ROC, Receiver Operating Characteristic Curves; AUC, area under curve ([a]Fig2 -ROC curves for SOFA vs. ICU and SOFA vs. MV)

**Figure legends**

**Figure 1: Graph comparing the calculated STSS and SOFA score patient categories' against each other.**

**Figure 2: Comparisons of the Area under the Receiver Operating Characteristic (ROC) Curves Predicting admission to ICU and requirement for mechanical ventilation.**



25
20
15
10
5
0
No. of Patients
0
1
2
≥3
STSS Scores
SOFA Scores
>11
10-11
8-9
6-7
4-5
2-3
0-1


Figure 1

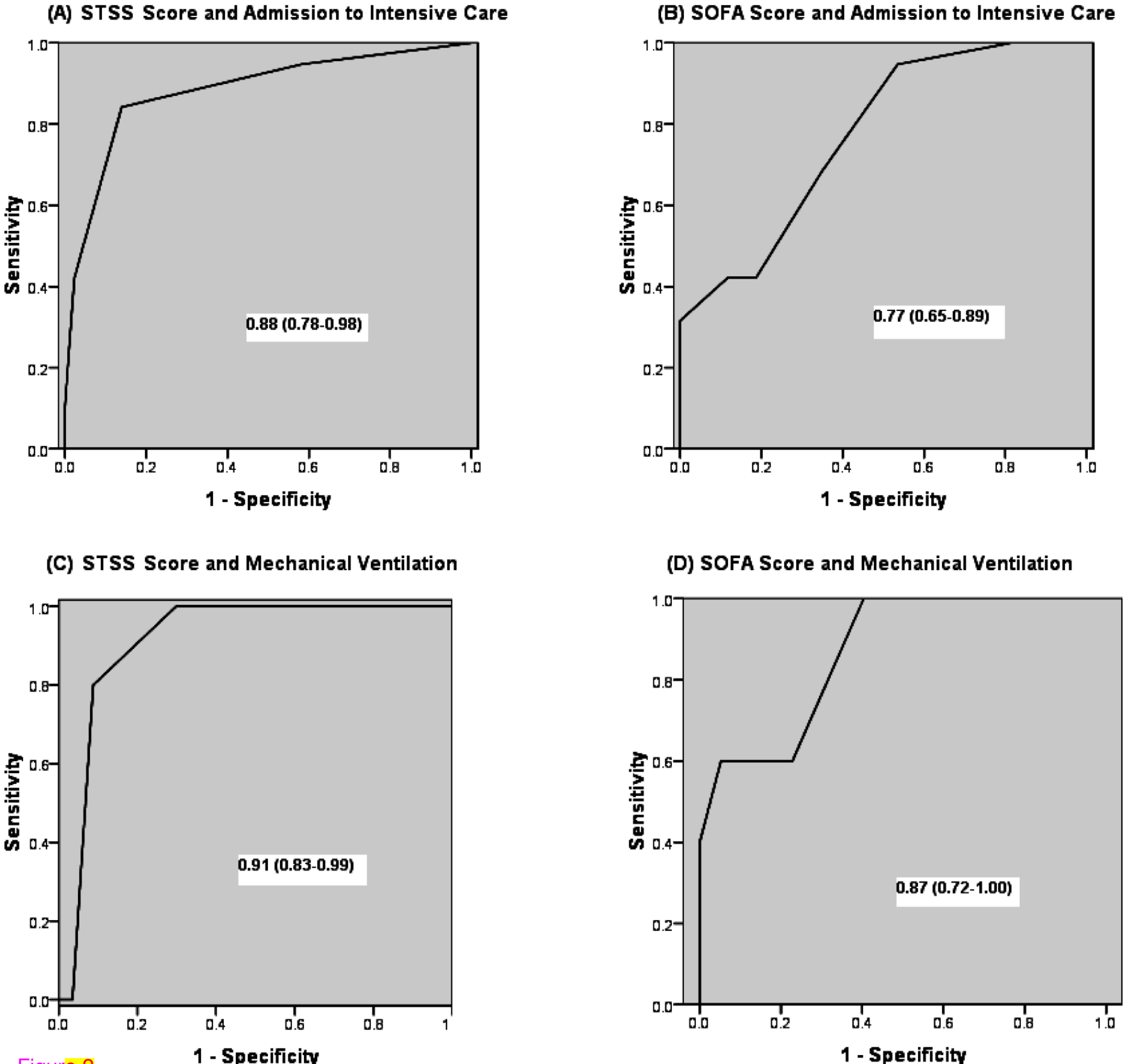

(A) STSS Score and Admission to Intensive Care
Sensitivity
1 - Specificity
0.88 (0.78-0.98)
(B) SOFA Score and Admission to Intensive Care
Sensitivity
1 - Specificity
0.77 (0.65-0.89)
(C) STSS Score and Mechanical Ventilation
Sensitivity
1 - Specificity
0.91 (0.83-0.99)
(D) SOFA Score and Mechanical Ventilation
Sensitivity
1 - Specificity
0.87 (0.72-1.00)

Figure 2