The South African triage scale (adult version) provides valid acuity ratings when used by doctors and enrolled nursing assistants

L’échelle de triage sud-africaine (version adulte) fournit des taux de triage d’une acuité valide lorsqu’elle est utilisée par des médecins et des aides-soignants inscrits

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KEYWORDS
Triage; Emergency centre; Validity; South African Triage Scale; Over-prediction; Under-prediction

Abstract Objectives: To estimate the validity of triage ratings by South African nurses and doctors with training and practical experience using the South African Triage Scale.
Methods: Five emergency physicians and 10 enrolled nursing assistants, who had been trained in the use of the South African Triage Scale, were selected via convenience sampling to retrospectively triage adult emergency centre vignettes. Participants independently assigned triage ratings to 100 written vignettes unaware of the ratings given by others. Triage ratings were compared with ratings of two experts from the South African Triage Group. Standard validity indicators including

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sensitivity, specificity, positive predictive value and negative predictive value were used to estimate the validity for the combined group of emergency physicians and enrolled nursing assistants. Associated percentages for over-/under-triage were used to further assess validity within the South African context and over-/under-prediction to further assess practical application of the South African Triage Scale.

**Results:** On average over all acuity levels, sensitivity was 75%, specificity 91%, under-triage occurred 10% and over-triage 15% of the time. The positive predictive value was 74% and negative predictive value 91%.

**Conclusion:** The results of this study fall within the accepted range of over-/under-triage and indicate that the South African Triage Scale is valid when used by emergency physicians and nurses to triage emergency centre vignettes under South African conditions. Further research into appropriate reference ranges for extent of over-/under-triage and over-/under-prediction within each acuity level is recommended.

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**Abstract**

**Objectif:** Estimer la validité des taux de triage effectués par des infirmiers et médecins sud-africains disposant d’une formation et d’une expérience pratique dans l’utilisation de l’échelle de triage sud-africaine.

**Méthodes:** Cinq médecins urgentistes et 10 aides-soignants inscrits, formés à l’utilisation de l’échelle de triage sud-africaine, ont été sélectionnés au moyen d’un échantillonnage de commodité afin de trier rétrospectivement les vignettes d’un centre d’urgence pour adultes. Les participants ont indépendamment assigné des taux de triage à 100 vignettes écrites, sans connaître les taux attribués par les autres. Les taux de triage ont été comparés aux taux de deux experts du Groupe de triage sud-africain. Des indicateurs de validité standard, comme la sensibilité, la spécificité, la valeur prédictive positive et la valeur prédictive négative, ont été utilisés afin d’estimer la validité pour l’intégralité du groupe composé par les médecins urgentistes et les aides-soignants inscrits. Des pourcentages associés pour le sur-/sous-triage ont été utilisés afin d’évaluer de manière plus approfondie la validité dans le contexte sud-africain, ainsi que pour le sur-/sous-prédiction afin d’évaluer de manière plus approfondie l’application pratique de l’échelle de triage sud-africaine.

**Résultats:** En moyenne sur tous les niveaux d’acuité, la sensibilité était de 75 %, la spécificité de 91 %, un sous-triage se produisait 10 % du temps et un sur-triage 15 % du temps. La valeur prédictive positive était de 74 % et la valeur prédictive négative était de 91 %.

**Conclusion:** Les résultats de cette étude sont compris dans la fourchette acceptée de sur-/sous-triage et indiquent que l’échelle de triage sud-africaine est valide lorsqu’elle est utilisée par des médecins urgentistes et des infirmiers pour trier les vignettes d’un centre d’urgence dans des conditions sud-africaines. Il est recommandé de procéder à une étude supplémentaire des fourchettes de référence appropriées afin de mesurer l’ampleur du sur-/sous-triage et de la sur-/sous-prédiction à chaque niveau d’acuité.

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**African Relevance**

- The reality of high volumes of patients accessing emergency centres is a common characteristic in the African setting
- The South African Triage Scale is currently being used in six sub-Saharan countries
- Resource limited settings in Africa may benefit from a reliable, valid and user-friendly triage tool such as the South African Triage Scale

**What’s new**

- The South African Triage Scale is a valid tool that may be further implemented in similar resource limited settings
- Mis-prediction characteristics are determined by the setting in which triage takes place (primary, secondary or tertiary health facilities)
- It reveals both potential poor care and/or resource wastage in these different settings

**Introduction**

Emergency centre (EC) triage is the process of sorting and filtering patients based on medical urgency. It aims to determine a patient’s acuity level in order to facilitate timely and effective care before their condition worsens. A patient’s acuity level is defined as the urgency for effective care. The South African Triage Scale (SATS) is an initial measure of patient acuity in
the EC that was developed by the South African Triage Group (SATG). It assesses medical urgency based on physiologic parameters and a list of clinical discriminators (Appendix A). Similar to the Manchester Triage System (MTS) and the Canadian Emergency Department Triage and Acuity Scale (CTAS), the SATS incorporates target times to treatment. Patients are categorised into one of four acuity levels: red (emergency – should be seen immediately), orange (very urgent – should be seen in less than 10 min), yellow (urgent – should be seen in less than 60 min), green (routine – should be seen in less than four hours). The SATS was intentionally designed for use by an Enrolled Nursing Assistant (ENA) due to the limited numbers of doctors and professional nurses in South Africa. ENAs are entry-level nurses that have qualified with a one-year certificate.

Previous studies provide evidence of ENA competence and reliability using the SATS. The SATS has been implemented, monitored and refined in the public and private health care setting since 2006. To date no study has assessed the validity of the SATS in South African ECs using South African experts as a reference.

The validity of a triage scale is an important measure that tells us how close an acuity rating assigned using that scale is to the true acuity of that patient. Reliability is an equally important measure, but it refers to agreement between raters and within raters, using the scale, without reference to the patient’s true acuity. Previous reports describe the fact that triage scales have no uniquely defined reference standard and therefore one of the challenges in estimating validity lies in the task of meaningfully comparing validity assessments of triage scales across studies and contexts. Type of reference standard used (whether it be patient disposition, length of stay in hospital, resource utilisation, etc. or an expert panel) will influence the performance characteristics of that scale. Even though triage scales inherently differ depending on their context and design, there should ideally be some uniformity on the most appropriate performance characteristics when reporting on triage scale validity with accepted reference ranges that serve as a guideline and reference criteria.

In the current literature mis-triage is defined as the extent of over-/under-triage relative to true acuity. In this study we have classified mis-triage into two different types (i) mis-triage with reference to true acuity levels and (ii) mis-prediction with reference to raters’ assigned acuity levels. We refer to mis-triage in our sensitivity analysis as over-/under-triage, and mis-prediction in our analysis of positive predictive values (PPV) as over-/under-prediction.

The objectives of this study are to estimate the validity of the SATS used by both emergency physicians and ENAs on a general adult EC patient population in South Africa. Comparing emergency physician and ENA ratings to those of a local expert panel, we will answer the following questions:

(1) What is the sensitivity and specificity of the SATS and the associated percentage of over-/under-triage?
(2) What is the PPV and negative predictive value (NPV) of the SATS and the associated percentage of over-/under-prediction?

Methods

Study design

A validation study conducted on a series of vignettes that had been collected prospectively from real patients.

Study sample

Five emergency physicians and 10 ENAs were selected using convenience sampling, and invited to participate in our validation study. Individuals came from different geographically located health facilities and represented different sub districts within the Western Cape Province. Validity was assessed using adult vignettes as suitable proxies for live triage cases. Based on extensive use in other studies and their advantage in terms of cost and time, this method is particularly useful for a less developed country such as South Africa.

Hundred adult vignettes were prospectively abstracted from randomly selected actual EC case presentations at a secondary hospital and have been previously referenced in a reliability study. Vignettes covered characteristics such as gender, age, presenting complaint, mode of arrival and vital signs. Appendix B shows examples.

Methods of measurement and data collection

ENAs and emergency physicians attending mandatory SATS training sessions in 2009 were required to complete retrospective triage on these vignettes as part of an evaluation exercise. This was done in a classroom environment where candidates were asked to use the SATS to independently triage written sets of vignettes into one of four triage categories (Appendix A). Five emergency physicians and ten ENAs completed the sets of vignettes. In total 15 raters assessed 100 vignettes (1500 assessments).

The SATS categories assigned by the emergency physicians and ENAs were compared to a reference standard that was generated using two local experts from the SATG who had in-depth knowledge of the SATS and experience in its use and application. They independently reviewed the 100 vignettes (with additional information on use of resources, length of stay in hospital and disposal), which allowed for comprehensive expert judgement in generating a reference standard and classified
them into an acuity level. The experts’ ratings were in perfect agreement for all 100 vignettes. The ratings for each vignette could therefore be aggregated into a single set of “true” acuity levels that served as a reference standard in this study.

For the purposes of this study we will, for clarity, define Tables 1 and 2 the measures used to report on validity of the SATS. These measures apply to every triage acuity category and Table 2 uses the yellow/urgent triage category as an example to elaborate.

Data analysis

Validity was assessed by calculating the sensitivity, specificity, and associated over-/under-triage relative to the experts’ acuity assignments; and PPV, NPV, and associated over-/under-prediction relative to the raters’ acuity assignments. Histograms were designed to illustrate and visually compare mis-triage and mis-prediction at each acuity level. Mis-triage was interpreted using the accepted range for average under-triage of not more than 5–10%, which the American College of Surgeons Committee on Trauma (ACSCOT) considers unavoidable and an associated average over-triage rate of 30–50%. To our knowledge no accepted norms exist for predictive values. We therefore used the ACSCOT ranges to interpret the extent of average over-/under-triage only.

The literature indicates that AGREE 7 for Windows is the only software programme that allows calculations of the kappa statistic in relation to a reference standard as well as an option to determine unique weights. We found the AGREE 7 package difficult to use, with limited documentation and producing in some cases erroneous results. After several unsuccessful attempts to contact their support service, we chose not to report the kappa statistic and rather focused on the above-mentioned standard validity indicators.

It is known that the kappa statistic depends on the distribution of cases and number of categories, which limits generalizability to settings with different distributions. In addition, the kappa coefficient does not reflect differences in agreement at individual ordinal values (here acuity levels), and therefore only provides a one-dimensional overview.

Results

Five emergency physicians and 10 ENAs each evaluated the 100 vignettes (1500 assessments). Table 3 summarizes the sensitivity analysis and Table 4 the predictive value analysis. Table 3 shows that, on average, under-triage (10%) occurs less frequently than over-triage (15%), relative to the true acuity assigned by experts. Table 4 shows that, relative to the acuity assigned by the raters, under-prediction (11.4%) occurs on average less frequently than over-prediction (14.8%).

Fig. 1 summarizes all vignettes with acuity levels as assigned by the local experts, and illustrates the probability that blinded raters using the SATS will over-/under-triage vignettes at each acuity level. It shows, for instance, that 22% of the true “emergency” vignettes were under-triaged by one acuity level and that no true “emergency” vignettes were mis-triaged as “urgent” or “routine.”

Fig. 2 summarizes all vignettes according to acuity levels as assigned by the raters, and illustrates the probability that the given ratings are over-/under-predictions of the true acuity (with reference to the experts’ ratings). Fig. 2 indicates, for instance, that about 28% of vignettes triaged “emergency” by the raters were over-predicted by one acuity level, implying that they were actually “very urgent”, about 3% were over-predicted by two acuity levels (i.e. true acuity was “urgent”) and 1% were over-predicted by 3 acuity levels (i.e. true acuity was “routine”).

Discussion

This study assessed the validity of the SATS when used by emergency physicians and nurses. The SATS demonstrated good average sensitivity (75%) and specificity (91%). The extent of average over-triage (15%) and under-triage (10%) fell within the given ACSCOT ranges. The average PPV (74%) and NPV (91%) were equally high and the extent of average over-prediction (15%) was higher than under-prediction (11%).

Sensitivity, specificity and percentage over-/under-triage are accuracy summaries (accuracy defined here as the distance from the truth). These summaries may be compared across studies and do not depend on the acuity distribution in a given setting. By contrast, predictive values and over-/under-prediction provide information on actual performance in a given setting. In practice, when a patient is assigned a particular acuity level, the true acuity is not known, and what is of interest from the patient care and resource management perspective is how likely that assigned acuity is to be correct. In our study, the acuities in the set of vignettes represented the distribution at secondary and tertiary level hospital emergency centres.

Under-triage and under-prediction are a concern to patient care, implying longer waiting times, delayed definitive patient care, leading to increased mortality and morbidity. Over-triage

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Example of definitions of performance indicators for the acuity “urgent”.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity (%)</td>
<td>⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌧ ⌘</td>
</tr>
</tbody>
</table>
and over-prediction do not directly impinge on patient care, but may indirectly compromise patient care for the collective because overstretched and limited resources are diverted from those in genuine need that are truly a higher priority. Over- triage and over-prediction are therefore an important consideration in resource poor settings, where resource allocation, if inappropriately prioritized, may lead to loss of life. Furthermore over- triage/prediction may result in an over-utilization of finite resources and create an unnecessary financial burden to the health care system, as has been reported in other countries.37 While the extent of under- and over-triage reflects the accuracy of the SATS implementation in a way that is comparable across settings, it is the extent of under- and over-prediction that represents the actual potential impact on patient care and resources in a given setting.

The consequences of mis-assignment of acuity depend on the true acuity level and the extent of mis-assignment. For instance, if the true acuity is “emergency” and the assigned acuity is “very urgent” (an under-triage of the acuity level “emergency” and an under-prediction for the acuity level “very urgent”), then a patient only waits 10 min longer for care, whereas if the true and assigned acuity is “urgent” (“routine”) respectively, the patient that should only wait 1 h waits 3 h longer than appropriate.

Consequences of mis-triage versus mis-prediction

With reference to the expert triage ratings, we observed a high percentage of under-triage for true “emergency” vignettes (22%). However this was only under-triage by one acuity level implying that the patient would wait 10 min longer, as opposed to an hour or 4 h longer. Within the true “very urgent” vignettes 14% were under-triaged, 10% by one acuity level (i.e. 1 h longer waiting time) and 4% by two acuity levels (i.e. 4 h longer waiting time). This raised some concern, as the increased waiting times imply compromised patient care. Among the true “urgent” vignettes, 6% were under-triaged by one acuity level (i.e. 3 h additional waiting time).

Of concern in secondary and tertiary emergency centres is that, of the vignettes triaged as “routine” by the raters, 15.5% were under-predictions by one acuity level (i.e. 3 h longer waiting time than would be required given the true acuity) and 13% were under-predictions by two acuity levels (i.e. 4 h longer waiting time). In addition, within the group of vignettes triaged by the raters as “urgent”, 14% were under-predictions by one acuity level (i.e. 1 h additional waiting time). These summaries reflect the accuracy in practice, for settings represented by the patient mix in this study.

With reference to the expert triage ratings, high over-triage was observed within the true “urgent” (21%) and “routine” (32%) patients.

When using the raters’ triage decisions as a reference, over-prediction was observed in 32% of the vignettes triaged as “emergency” and 17% of the vignettes triaged “very urgent”. Over-prediction of the “emergency” acuity was mostly only by one acuity level, i.e. the true acuities were predominantly “very urgent”, an acuity that requires attention within 10 min rather than immediately. Of more concern, in terms of utilization of resources, is over-prediction of the “very urgent” acuity. The vignettes in this study reflect the distribution of acuities in the population attending secondary level hospitals, where

<table>
<thead>
<tr>
<th>Vignette (n)</th>
<th>Triage ratings (n)</th>
<th>EMERGENCY Physicians and ENAs Combined 15 raters for 100 vignettes (a total of 1500 ratings)</th>
<th>Performance relative to experts as the criterion reference standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert SATS Category</td>
<td></td>
<td>Sensitivity</td>
<td>Specificity</td>
</tr>
<tr>
<td>Emergency</td>
<td></td>
<td>8</td>
<td>120</td>
</tr>
<tr>
<td>Very urgent</td>
<td></td>
<td>45</td>
<td>675</td>
</tr>
<tr>
<td>Urgent</td>
<td></td>
<td>33</td>
<td>495</td>
</tr>
<tr>
<td>Routine</td>
<td></td>
<td>14</td>
<td>210</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>74.9</td>
<td>90.9</td>
</tr>
</tbody>
</table>

* These values correspond to exact agreement with expert SATS category for vignettes.
| n/a – Not applicable. |

Table 3. Summary of combined emergency physician and nurse agreement with the experts SATS rating of vignettes (%).
53% were considered emergency or very urgent by the reference standard, requiring admission. This is similar to previous studies at other urban secondary level hospitals that also have 50% of their EC presentations being admitted as emergency or very urgent patients.\textsuperscript{10}

<table>
<thead>
<tr>
<th>Raters SATS category</th>
<th>Triage ratings (n)</th>
<th>PPV (%)</th>
<th>NPV (%)</th>
<th>Over-prediction (%)</th>
<th>Under-prediction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency</td>
<td>138</td>
<td>68.1</td>
<td>98.1</td>
<td>31.9</td>
<td>n/a</td>
</tr>
<tr>
<td>Very urgent</td>
<td>693</td>
<td>78.8</td>
<td>84.4</td>
<td>17.4</td>
<td>3.8</td>
</tr>
<tr>
<td>Urgent</td>
<td>469</td>
<td>76.3</td>
<td>86.7</td>
<td>10</td>
<td>13.7</td>
</tr>
<tr>
<td>Routine</td>
<td>200</td>
<td>71.5</td>
<td>94.9</td>
<td>n/a</td>
<td>28.5</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>73.7</td>
<td>91</td>
<td>14.8</td>
<td>11.5</td>
</tr>
</tbody>
</table>

**Fig. 1** Graphical displays of the sensitivity, over-/under-triage of SATS for emergency, very urgent, urgent and routine acuity levels.

**Fig. 2** Graphical displays of the PPV, under- and over-prediction of SATS for emergency, very urgent, urgent and routine acuity levels.
The predictive values and percentages of over and under-prediction depend upon the acuity distribution. In general, the positive predictive value of an acuity will tend to increase as its frequency of occurrence increases. In a primary care setting, where the distribution of acuity is skewed towards urgent and routine, potential over-prediction and resource wastage is a concern. Conversely, as one moves higher up the health care referral chain to secondary, tertiary and highly specialised quaternary levels of care, where the distribution is skewed towards higher acuity levels, the PPV will tend to increase at emergency and very urgent acuity levels, and decrease for urgent and routine acuities, indicating that under-prediction is a concern. This emphasizes the desirability of appropriate access at all times to the correct levels of care in an optimally and rationally organised health care system.

Limitations

A limitation of any study assessing the validity of triage scales is the lack of an appropriate reference standard. We chose to address this problem by combining the use of experts and outcome markers in that two triage experts from the SATG made informed triage decisions based on the use of SATS and outcome markers such as hospital admission, death, length of stay and resource utilization. Even though abstracted from real EC presentations, the use of written vignettes was considered a second limitation, as non-verbal cues and visual information can never be entirely accurate in written vignettes, and may have affected the triage decision for the raters.

The reference ranges for average over- and under-triage provided by the ACSCOT are a limited way of interpreting the standard validity indicators in this triage validity study as the reference ranges were developed for pre-hospital trauma triage, they only pertain to average over/under-triage and not to each acuity level, and there are no reference ranges for predictive values.

Conclusion

The average sensitivity over all acuity levels was 75% and specificity 91%. Average under-triage (10%) and over-triage (15%) with respect to the true acuity fell within the accepted ACSCOT ranges, and confirms previous studies\(^{10}\) that have shown similar average under-triage (7.8%) and over-triage (13.6%) with respect to the true acuity on SATS performance used among South African nurses. The results of this study indicate that the SATS has good performance characteristics and is a valid scale, which may be further implemented in similar settings in South Africa.

Mis-prediction characteristics are determined by the setting in which triage takes place (primary, secondary or tertiary health facilities) and identify both poor care and/or resource wastage in these different settings.

Further research into accepted norms for extent of over-/under-triage and over-/under-prediction at different acuity levels in the hospital context for both trauma and medical problems is recommended to ensure that appropriate reference ranges and guidelines are available for less developed countries.

Funding

None.

Conflict of interest

The authors declare that there is no conflict of interest.

Ethics

This study was granted ethics approval from the Research Ethics Committee, University of Cape Town (REC REF: 063/2005).
### Appendix A. The South African Triage Scale

<table>
<thead>
<tr>
<th>ADULT TRIAGE SCORE</th>
<th>© South African Triage Group 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility</td>
<td>3</td>
</tr>
<tr>
<td>RR</td>
<td>less than 9</td>
</tr>
<tr>
<td>HR</td>
<td>less than 41</td>
</tr>
<tr>
<td>SBP</td>
<td>less than 71</td>
</tr>
<tr>
<td>Temp</td>
<td>Cold OR Under 35</td>
</tr>
<tr>
<td>AVPU</td>
<td>Confused</td>
</tr>
<tr>
<td>Trauma</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Colour</th>
<th>RED</th>
<th>ORANGE</th>
<th>YELLOW</th>
<th>GREEN</th>
<th>BLUE</th>
<th>DEAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>TENS</td>
<td>7 or more</td>
<td>5-6</td>
<td>3-4</td>
<td>0-2</td>
<td>DEAD</td>
<td></td>
</tr>
<tr>
<td>Target time to treat</td>
<td>Immediate</td>
<td>less than 10 mins</td>
<td>less than 60 mins</td>
<td>less than 240 mins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanism of injury</td>
<td>High energy transfer</td>
<td>Shortness of breath - acute</td>
<td>Coughing blood</td>
<td>Chest pain</td>
<td>Haemorrhage - uncontrolled</td>
<td>Haemorrhage - controlled</td>
</tr>
<tr>
<td>Seizure - current</td>
<td>Seizure - post ictal</td>
<td>Focal neurology - acute</td>
<td>Level of consciousness reduced</td>
<td>Psychosis / Aggression</td>
<td>Threatened limb</td>
<td>Dislocation - other joint</td>
</tr>
<tr>
<td>Presentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burn - face / inhalation</td>
<td>Burn over 20%</td>
<td>Burn - electrical</td>
<td>Burn - circumferential</td>
<td>Burn - chemical</td>
<td>Poisoning / Overdose</td>
<td>Abdominal pain</td>
</tr>
<tr>
<td>Hypoglycaemia - glucose less than 3</td>
<td>Pregnancy &amp; abdominal trauma or pain</td>
<td>Pregnancy &amp; trauma</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Over 12 years / taller than 150cm
Appendix B. Acuity Assessment: Examples of vignettes

<table>
<thead>
<tr>
<th>Vignette Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: A fragile looking 29 year old woman is assisted into your ED on crutches. She is breathing very rapidly and says that she has been coughing and vomiting for the past few days. She states that she is not in much pain (2/10). She explains to you that she has not been well enough to look after her child. RR 30, HR 160, BP 109/65, 37.5°C</td>
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<td>2: “I have had chest pain for 2 weeks now and have a sensation of pins and needles in my left arm and face” reports a 26 year old woman that is carried into your ED on a stretcher. She does not complain of any pain but looks very fearful. RR 23, HR 72, BP 115/60, 36.3°C, HGT 4.4, HB 11.5</td>
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<td>3: Paramedics walk in a 48 year old woman who complains of a moderate headache (5/10) and weakness in her left arm. She is mobile and states that she has had a previous CVA. She is tearful and anxious. RR 20, HR 117, BP 205/136, 36°C, HGT 7.9, HB 10</td>
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<td>4: A 26 year old man is brought into your ED by paramedics. He is on a stretcher. He is screaming and shouting about his severe abdominal pain (9/10). He starts throwing his clothes around the ED and becomes disruptive. RR 20, HR 65, BP 131/95, 36.5°C HGT 5.9 HB 14.5</td>
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Appendix C. Short Answer Questions

Test your understanding of the contents of this original paper (answers can be found at the end of the regular features section)

1. Which of the following data analysis methods for triage scale validation studies would provide detail on the extent of mis-prediction?
   a) Multiple logistic regression
   b) Percentage correlation
   c) Receiver operating characteristic curve
   d) Sensitivity analysis with associated over- and under-triage
   e) Neural nets

2. What reference standard is used for this triage scale validation study?
   a) Patient disposition
   b) Resource utilisation
   c) Expert panel
   d) Average length of stay
   e) Intervention

3. Which estimate is important when considering appropriate resource utilisation at triage?
   a) Quadratically weighted kappa
   b) Odds ratio
   c) Negative predictive value with associated over-prediction
   d) Likelihood ratio
   e) Sensitivity and associated under-triage

References