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# Educational intervention in triage with the Swedish triage scale RETTS©, with focus on specialist nurse students in ambulance and emergency care – A cross-sectional study

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ABSTRACT

*Aim:* To determine the reliability of application of the RETTS© triage scale after an educational intervention using paper-based scenarios in emergency care education.
*Background:* Knowledge about and education in triage are important factors in triagescale implementation. Presenting students with a large number of triage scenarios is a common part of triage education.
*Methods:* In this prospective cross-sectional study at two universities students undergoing education in emergency care used RETTS© to assess triage level in 46 paper-based scenarios.
*Results:* 57 students in the study made 2590 final triage decisions. Fleiss Kappa for final triage was 0.411 which is in the lower range of moderate agreement. In 25 of 46 (53.4%) scenarios, final triage levels did not agree about whether the case was stable or unstable.
*Conclusion/Implications:* Application of the RETTS© triage scale after an educational intervention with paper-based simulation in emergency care education resulted in moderate agreement about the final levels of triage.

## 1. Background

Patient assessment (i.e., triage) in prehospital and in-hospital emergency care is a complex and important assignment when identifying and prioritizing patients with different care needs and perceived symptoms of illness or injury [1,2]. Triage assessment is generally based on signs and symptoms, and it determines the resources needed to treat and care for the patient [3,4]. Even if the patient assessment is based on an established triage scale individual assessments are often far from similar. In a reliability study, Wireklint et al. (2018) found discrepancies in assessed triage levels when nurses in an emergency department used a triage scale, with the result that stable and unstable cases were not properly identified and distinguished [5].

Education in triage can potentially contribute to an increased accuracy in the assessments. However, the scope and structure of education can vary as well as the potential impact on accuracy [6,7]. Although registered nurses (RNs) often are responsible for triage in an international context, several different professionals, like specialist nurses (SNs) and physicians also perform triage [8,9]. Showing acceptable agreement regardless of profession [10]. In Sweden, triage assessment in emergency care is performed by either qualified RNs or SNs, and their education differs accordingly. There is no national requirement that RNs in emergency care must be qualified as SNs, although specialist education among RNs has become more common the last decade [11]. An RN's education includes three years of university studies leading to a Bachelor degree in Nursing. With one additional year of education, an RN can become an SN and receive a Postgraduate Diploma in Specialist Nursing Prehospital or In-hospital Emergency Care and a Master degree with a major in Caring/Nursing Science [3,12]. A key task for RNs and SNs in emergency care is to assess patients in a structured way and to identify and prioritize their needs and determine what level of care is adequate [13,14]. There is a challenge to determine what a necessary triage competence is for RNs and SNs working in prehospital or in-hospital emergency care. However, in Sweden there is

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no national requirements that regulate the minimum education, experience, and training required for patient assessment.

Triage can be seen as a purely objective process or as a partly subjective assessment that includes experience-based critical thinking [15]. Even when triage scales are used as an objective way of making an accurate patient assessment, the accuracy still depends on several factors, including the design of the scale, nurse's knowledge about and education in triage [16,17]. When applying triage systems, introduction to and education in that system should be seen as important parts of the implementation, even if the scope and structure of educational interventions differ [9,18].

Currently numerous different triage scales are in use in different parts of the world, this without a consensus on strengths or flaws of the scales. Examples are the Australian Triage Scale (ATS) [19], the Canadian Emergency Department Triage and Acuity Scale (CTAS) [20], the Emergency Severity Index (ESI) [21], the Manchester triage system (MTS) [22], and the South African Triage Scale (SATS) [23]. In Sweden, the majority of emergency departments (ED) and prehospital care units use the Rapid Emergency Triage Treatment System (RETTS©) [3,11], which is based on the earlier Swedish system called Medical Emergency Triage Treatment system (METTS) [24,25]. RETTS© is mostly used in Scandinavian but [26,27], but have also been used in Kenya [28] and Nepal [29] for example. In general, triage scales are used to assess the stability of patients who seek emergency care. This assessment is based on medical history, symptoms, and sometimes vital signs (VS) such as respiratory rate, heart rate and body temperature. Some scales provide priority as a part of the assessment (CTAS, ATS, SATS, ESI), while others like MTS and RETTS© also include logistic flows systems [3,30–32]. However, there is a lack of studies comparing triage scales' validity for patient outcome [33].

Educational intervention, especially triage-specific education, has the potential to improve the accuracy and efficiency of triage. A wide variety of methods are currently used in triage education (lectures, reading of manuals and guidelines, activities like workshops and seminars, and simulations that can range from simple to complex), some of which may have advantages over others [34]. Paper-based scenarios are often used in emergency care training for both triage implementation and for evaluating outcomes. This method has the advantage that it is easy, repeatable, can reflect several different conditions, and is appropriate for training many people at once or for repeating scenarios under slightly altered conditions [35,36]. The aim of this study is to determine the reliability of application of the RETTS© triage scale after an educational intervention using paper-based scenarios in emergency care education.

## 2. Methods

### 2.1. Terminology

Throughout this paper, the term 'emergency care' refers to the patient assessment provided by registered nurses (RNs) in prehospital and in-hospital emergency care, and the term 'emergency care education' refers to specialist nurse (SNs) education in prehospital or in-hospital emergency care.

### 2.2. Design

The study was designed as a prospective cross-sectional study.

### 2.3. Settings and participants

This study was carried out at the departments of education for emergency care for SNs at two Swedish universities in 2018 and 2019. Education for SNs training in emergency care includes clinical placement relevant to the needs of the specific specialization. In addition to Caring/Nursing science, the education generally includes medical science, the scientific method, and specific contextual skills/knowledge [2,12]. The education also includes general principals of patient assessments, but there is no national requirement for training in specific triage scales [2,13,14].

Inclusion for this study was being an RN undergoing emergency care education, participating in the basic RETTS© education provided at each university, and consenting to participate in the study. The intention of offering a basic beginners RETTS© education was to attract those who were not previously trained or experienced in RETTS© triage. At the time of this study, 156 students have been admitted to these programs (109 in prehospital and 47 in in-hospital emergency care). When they were admitted and started their SN education, they each met the requirements for eligibility for the education, including being a qualified RN. However, there was no formal requirements that the students should have any previous experiences from prehospital or in-hospital emergency care. Participation was voluntary and both written and verbal information was provided prior to the study, and written approval was obtained from the participants.

### 2.4. Instrument

The students used RETTS© to assess the triage level in the patient scenarios.

RETTS© is a five-level scale based on a combination of chief complaint algorithms and VS usable on all who seek emergency care [25]. The VS have cut-off levels that result in a specific triage level. The Emergency Signs and Symptoms (ESS) algorithms includes one or more chief complaint. The scale has two colours of unstable (red, orange) and three colours of stable (yellow, green and blue). The unstable category red means that there is a threat to life in need of immediate assessment; category orange means that there is potentially a threat to life that requires emergency care immediately. The stable category yellow means the patient needs emergency care but there is no immediate threat to life; category green means there is no threat to life, but that care should be provided within a reasonable time. The stable category blue means there is less need for emergency care. When using RETTS©, both VS and ESS generate a triage level, the highest of them results in the final triage level [25].

### 2.5. Patient scenarios

The scenarios used in this study included information about gender, age, chief complaint, time of visit, symptom description, VS, and information on health status and history. The scenarios varied widely and linked to several specialties including internal medicine, trauma, orthopaedics, ear-nose-throat, paediatrics and ophthalmology. Chief complaints were for example "wound", "abdominal pain" or "fever". In each scenario, it was asked which specific ESS was used and what triage level both ESS and VS generated, as well as which final triage level was the result. The scenarios were originally taken from a database of 100 authentic patient cases from an Italian ED which have been used in studies in Sweden and Italy [5,37–39]. The 46 selected scenarios were chosen because they were thought to be suitable in a Swedish emergency care context as well as being suitable to this study about RETTS©. The translation was performed in two steps; from English to Swedish, and then back to English again to ensure that content was not lost during the translation process [5,40]. The translated scenarios were slightly adjusted to be applicable to the prehospital setting for those students studying to be SNs in prehospital care; the parts in the scenarios that indicated that the patient seeking emergency care at the ED were appropriately adjusted to reflect a patient seeking prehospital care. No details were changed in chief complaints, symptoms, or history. For this study, we used the 2014 version of RETTS© triage, the purpose being to be able to compare the results of this study to the findings of earlier studies [5].

### 2.6. Educational intervention

The educational interventions were given separately at the two universities with the same content and followed the same format. The participating students underwent a single basic training session in Triage/RETTS© consisting of two phases.

#### 2.6.1. Phase 1

Initially, a pre-recorded lecture (13 min) was shown to introduce the subject of triage scales and included the history, development, and basic function of various triage scales in emergency care, both internationally and in Sweden. It also included what function triage has in emergency care and the potential advantages and disadvantages of using these scales. The second pre-recorded lecture (10 min) introduced the students to RETTS© specifically, including the purpose of the system, how it is structured, and how to apply it. Application of RETTS© was exemplified in the lecture by a patient scenario structured in the same way as the ones the students later practiced in groups, and further on individually triaged during the data collection. The lectures were recorded by two separate teachers with several years of both clinical and research experience of triage.

#### 2.6.2. Phase 2

After the first phase explained above, the students were divided into randomly mixed groups consisting of 4–6 students. The group had access to a RETTS© manual and, without any time pressure, each group was asked to triage five different paper-based scenarios with varying chief complaints, VS, and histories. All groups were allowed to discuss the scenarios within the group. After a teacher-led review of the patient scenarios, all groups were allowed to discuss the triage assessments under supervision, with a focus on the application of RETTS©.

### 2.7. Data collection and analysis

Data collection took place during the first semester in a classroom at each university's SNs emergency education departments. Each student individually triaged 46 patient scenarios with access to a printed RETTS© manual. A representative from the research team was available to answer overall questions about data collection if needed, and then to collect the triaged patient scenarios when the student was finished. The data was analysed using IBM's Statistical Package for the Social Sciences (SPSS), version 26. In order to measure agreement, Fleiss unweighted Kappa (k) statistics was used. The results were interpreted according to the following values: $k < 0.20$ poor agreement, 0.21–0.40 fair agreement, 0.41–0.60 moderate agreement, 0.61–0.80 good agreement, 0.81–1.00 very good agreement [41].

### 2.8. Ethical considerations

The ethics of this study followed the Helsinki Declaration's principles of risk/benefits, voluntariness, informed consent and confidentiality [42]. An advisory opinion from the Southeast Ethics Committee was obtained (EPK 511–2018). Parts of the research team are teachers at the respective universities and teach in the emergency care education departments where the participants were students. Participation was voluntary and information was provided prior to the study both verbally and in written form. Written approval from the informants was obtained. The data was anonymized, and the results processed at the group level so that no data can identify individual students.

## 3. Results

Of a total of 156 students in the educational programmes, 59 chose to participate in the study, and two were excluded due to a very low response rate, resulting in 57 participants (36% of the student population) in the study. These students evaluated 46 patient's scenarios, for a total of 2590 final triage decisions (32 responses were missing). Fleiss Kappa for final triage was 0.411 which in the lower range of moderate agreement [41]. Four of out of the 46 scenarios (8.7%) resulted in complete agreement. The students' final assessments of triage level are illustrated in Fig. 1.

Fig. 2 presents the assessments dichotomized as either unstable (red, orange) or stable (yellow, green, and blue). Under this scheme, there is total agreement in 21 of the 46 (45.6%) scenarios. In 25 scenarios, there were disagreements about whether the situation was stable or unstable.

When the kappa value is calculated for each, previously decided specific triage level, there is good agreement (kappa = 0.719) about red (the highest triage level). Triage levels orange, yellow and green are in the category of fair agreement, with kappa values 0.315–0.388 [41] (Fig. 3).

## 4. Discussion

The results of this study show that there was a total agreement in final RETTS© triage level in only 8.7% (4 of 46) of the scenarios, which is perhaps not too surprising because previous studies have also shown large individual differences regarding triage assessment in emergency care [5,43]. What is more worrying is that less than half (21 of 46, 45.6%) of the participants were unanimous about whether the patient was stable or unstable. Previous studies have also shown that RETTS© is not an optimal triage tool in emergency care in terms of reliability [5,43] and the dispersion over the stable/unstable levels represent a potential patient safety risk [5,44]. The results indicate a need for further development of the RETTS© triage system to increase reliability. The scenarios that showed the highest amount of disagreement in this study could be used for development of RETTS©. Simultaneously, it also might be important to consider whether there are other triage systems that are better in terms of reliability.

Although the kappa indicates good agreement of 0.719 in scenarios suggesting the most urgent need for immediate care. In a study on the paediatric version of RETTS©, two-thirds of the children triaged to the unstable levels were later identified as non-emergent [45]. Decision-making in emergency care is a complex task where there is a risk that a non-optimal triage assessment may entail risks to patient safety [46], whether too little or too much care is assessed (because giving too much care removes resources potentially needed by other patients). A previous study has shown that 10% of patients in emergency care are exposed to risks related to patient safety [47] in pre-hospital care, that figure can be as high as 31% [43].

The basic educational intervention in this study was brief (4 h) and included recorded lectures and triaging five paper-based scenarios in groups under teacher-led review with focus on basic application rather than deeper reflection on the triage assessment when using RETTS©. In comparison, the implementation of ESI through education consists of a 3-hour theoretical presentation followed by practice sessions on paper-based scenarios, but this path too results in a suboptimal inter-rater agreement of triage classification [48]. Only 4 out of 46 scenarios in this study showed complete agreement, and most scenarios showed some dispersion often across the border between stable and unstable. In relation to this result, further education that especially focuses on scenarios where the disagreement is large could improve the application of triage [8,18].

Self or guided reflection on the differences and similarities in triage assessment, both in clinical practice and in education, can potentially lead to increased awareness about one's own ability to carry out triage, which can potentially decrease the amount of disagreement in triage assessments. Different pedagogical methods can be used to stimulate this reflection. Role playing in triage education, using context-based triage scenario, has shown being a practical method to help nurse students to learn triage in an effective way [49]. Furthermore, simulation (using manikins or standard patients) can be used as a part of education in emergency care, including triage to increase comprehension and self-

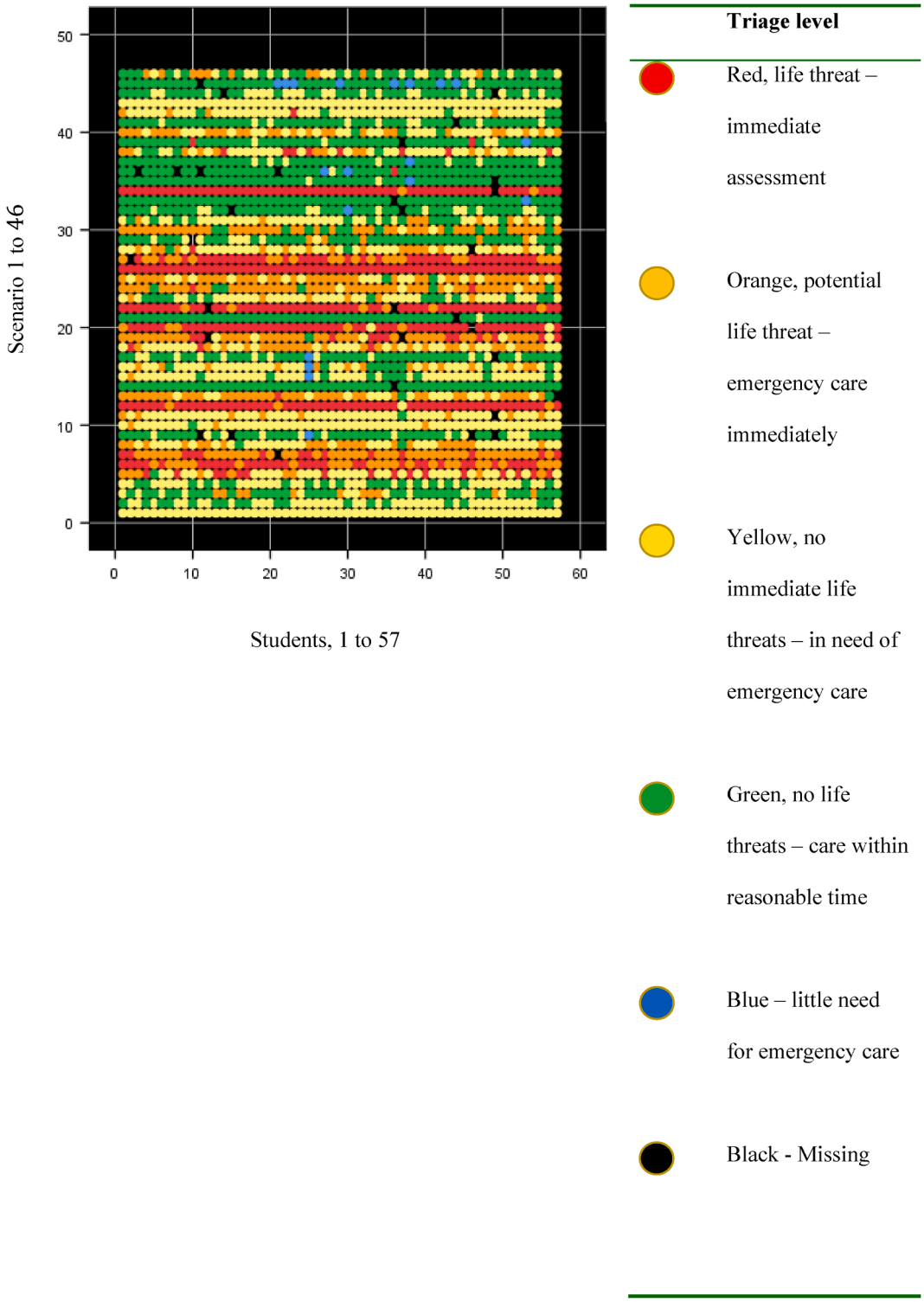


**Fig. 1.** Final triage levels for all students and all scenarios.

efficacy [50–52]. Online simulations designed with the Simple-to-Complex approach have the potential to increase the learning gain in clinical reasoning [53]. An online course in CTAS including case studies, discussions with teachers and peers regarding triage assessment, and interactive learning including quizzes for self-evaluation all led to participants reporting a positive impact on their triage practice [54]. The patient scenarios in this study that showed a total agreement about whether the patient was stable or unstable could potentially form the basis for beginner's simulations, and those with a disagreement could be used for simulations for more advanced students.

The Fleiss Kappa value for final triage level was 0.411 in this study, which is in the lower range of moderate agreement. This number can be compared to another study that showed a slightly higher value (moderate agreement of 0.562) using the same scenarios triaged by RNs working in ED [5], that study was based on the responses of clinically active RNs with experience of triage but without an educational intervention before the study. On the other hand our study is based on unexperienced RNs students who have undergone a basic education

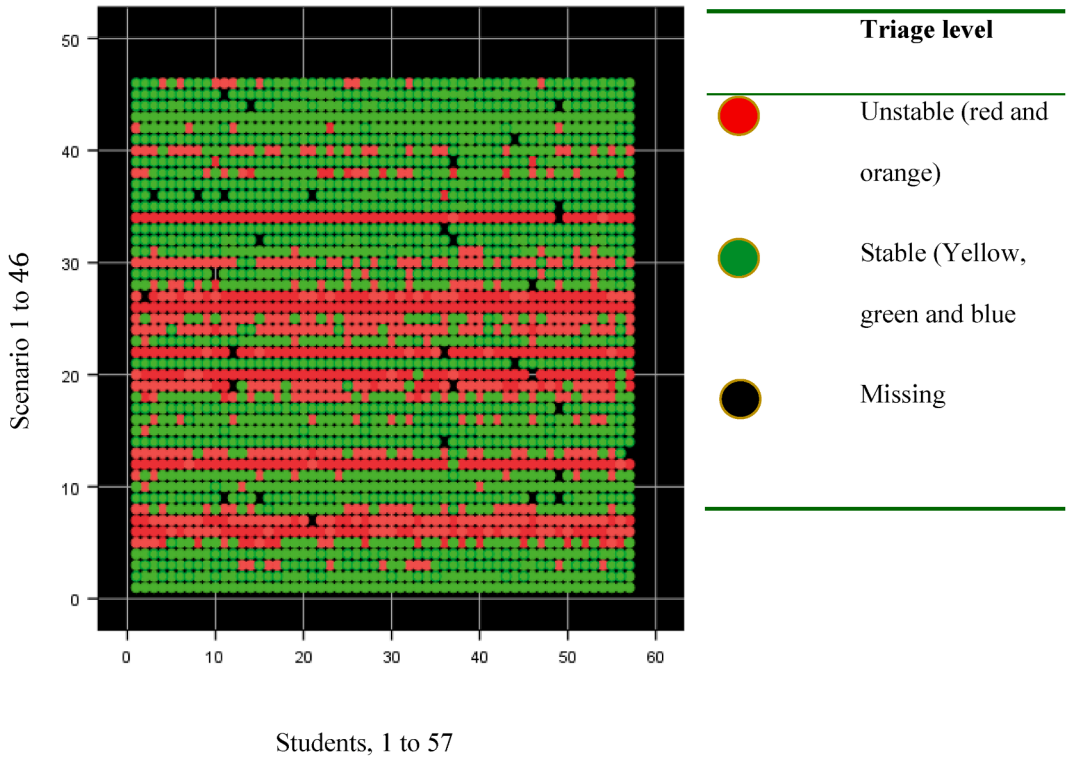


**Fig. 2.** Final triage levels for all scenarios dichotomized to stable or unstable.

| | Fleiss kappa value in each triage level | p-values |
|---|---|---|
| | 0.719 | 0.000 |
| | 0.329 | 0.000 |
| | 0.388 | 0.000 |
| | 0.315 | 0.000 |
| | -0.002 | 0.667 |

**Fig. 3.** Fleiss kappa value related to specific final triage level.

intervention with paper-based scenarios before the study. Surprisingly both groups did not distinguish between stable and unstable. Whether clinical experience is an important factor for a safer triage process when using RETTS© is uncertain. Other study's shows similar results for example, years of clinical experience did not affect triage assessments when using ESI triage [55] and nursing experience should not be seen as a superior criterion for triage assignment [56,57]. Adjusted education could potentially improve this situation. For this reason, it is important to develop guidelines for what is the minimum education, and experience for RNs and SNs as well as what kind of education that is required for patient assessment.

## 5. Strengths and limitations

Of the 159 possible participants, only 57 (36%) ended up participating in the study. We do not have the demographic data of the participants, such as age or gender, making us unable to analyse individual differences in triage between the participants. However the requirements for eligibility for the SNs education states that there is no formal requirements off previous experiences from prehospital or in-hospital emergency care. Furthermore, we offered a basic RETTS© training with the ambition attract beginners who lack education and experience in RETTS© rather than the already educated. The results should be interpreted cautiously and with the assumption that, although they are RNs, they have not previously education in RETTS© and no clinical experience of prehospital or in-hospital emergency care. RETTS© was developed from the earlier version METTS and the triage system has been constantly updated. It is not ambulatory to purchase the updates. For that reason, there are different versions in clinical practice. For this study, we used the 2014 version of RETTS© so as to be able to directly compare these results to those Wireklint et al. [5]. The scenarios used was paper-based descriptions of authentic cases that have been used in previous studies, so it is possible (though unlikely) that students may have read these cases before. Of course, for a standardized triage assessment to be effective, users must follow the instructions. Lack of compliance with the triage system can potentially be a risk to patient safety [58], and compliance with the RETTS© instructions is a factor that this study did not evaluate. However the purpose of this study was not to determine the validity of RETTS© triage scale rather to determine the reliability after an educational intervention.

The use of paper-based scenarios ensures that all participants have the same scenario to consider, but the realism of a clinical assessment cannot be fully reflected. According to Worster (2007), paper scenarios are comparable to live cases only in terms of inter-rater reliability [59], and the generalizability of the result should therefore be interpreted with caution. With 46 patient scenarios and 57 students, 2590 final triage decisions were made, with 32 missing triage assessments, which is a high response rate. This high response rate in combination with the moderate agreement indicated by the kappa value suggests that the results could be seen as acceptable reliable and representative for the group of participants.

## 6. Conclusions and implications

Application of the RETTS© triage scale after a basic educational intervention with paper-based simulation in emergency care education resulted in moderate agreement about the final levels of triage. In over half of the scenarios, there were disagreements about whether the patient in the scenario was stable or unstable. To increase the reliability in the application of RETTS©, both the triage system as such and the education intervention that form the basis for using the system should be further investigated. Specifically, the scenarios that showed the highest amount of disagreement could be used for both development of the system and play a central part of the education.

Accurate triage is of utmost importance for patient safety, and triage assessment in emergency care requires a high degree of knowledge and critical thinking as well as in-depth clinical reasoning, in addition to compliance with the triage scale used.

The results of this study indicate a need for education that stimulate reflection i.e. peer discussion, simulation and role playing in RETTS© triage for RNs and SNs with the ambition to decrease amount of disagreement in triage levels.

Future education in emergency care should focus on triage assessment and perhaps be enhanced with digital methods suitable for recurrent educational interventions. Digital simulations could include easily permuted scenarios, and complement or replace paper-based scenarios. The educational interventions proceeding triage assessment should be a central part for further studies including the scope and content and its correlation to the reliability of triage. Further research is needed on digital simulation suitable for recurrent education in emergency care.

## Ethical Statement

The ethical principles of the Helsinki Declaration (WMA, 2013) were practiced (EPK 511–2018).

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## Authors' details and contributions

The study was conducted in collaboration between Linnaeus University and the University of Borås. MO, AS, HA, AD, CE, SW and GNB conceived the study and contributed to the data collection. HA and CE supervised the conduct of the study. For data analysis and method selection MR, GNB and MO were responsible. MO drafted the manuscript and all authors contributed significantly to its revisions. MO and GNB take responsibility for the paper as a whole.

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## References

[1] Brice JH, Studnek JR, Bigham BL, Martin-Gill C, Custalow CB, Hawkins E, et al. EMS provider and patient safety during response and transport: proceedings of an ambulance safety conference. Prehos. Emerg. Care 2012;16(1):3–19.
[2] Sjölin H, Lindström V, Hult H, Ringsted C, Kurland L. What an ambulance nurse needs to know: A content analysis of curricula in the specialist nursing programme in prehospital emergency care. Int. Emerg. Nurs. 2015;23(2):127–32.
[3] Triage Methods and patient Flow Processes in Emergency Departments: A Systematic Review. Summary and conclusions. SBU Yellow Report No. 197, Swedish Council on Health Technology Assessment, April 2010. In Swedish.
[4] FitzGerald G, Jelinek GA, Scott D, Gerdtz MF. Emergency department triage revisited. Emerg. Med. J. 2010;27(2):86–92.
[5] Wireklint SC, Elmqvist C, Parenti N, Goransson KE. A descriptive study of registered nurses' application of the triage scale RETTS(c); a Swedish reliability study. Int. Emerg. Nurs. 2018;38:21–8.
[6] Rahmati H, Azmoon M, Meibodi MK, Zare N. Effects of triage education on knowledge, practice and qualitative index of emergency room staff: quasi-interventional study. Bull. Emerg. Trauma 2013;1(2):69.
[7] Tadrisi SD, Siavash Vahabi Y, Ghayem S, Ebadi A, Daneshmandi M, Saghafinia M. Comparing the effect of triage education in lecture and multimedia software on nurses learning. Iran. J. Crit. Care Nurs. Spring 2011;4(1):7–12.
[8] Innes K, Plummer V, Considine J. Nurses' perceptions of their preparation for triage. Aust. Emerg. Nurs. J. 2011;14(2):81–6.
[9] Dong SL, Bullard MJ, Meurer DP, Blitz S, Holroyd BR, Rowe BH. The effect of training on nurse agreement using an electronic triage system. Can. J. Emerge. Med. 2007;9(4):260–6.
[10] Pishbin E, Ebrahimi M, Mirhaghi A. Do physicians and nurses agree on triage levels in the emergency department? a meta-analysis. Notfall+ Rettungsmedizin 2019;22(5):379–85.
[11] Farrokhnia N, Göransson KE. Swedish emergency department triage and interventions for improved patient flows: a national update. Scand. J. Trauma Resuscit. Emerg. Med. 2011;19(1):72.
[12] The higher education ordinance (1993:100). Stockholm: Ministry of Education and Research.
[13] The Swedish National Association of Emergency Nurses and The Swedish Society of Nursing, 2017. Competence description for registered nurse (RN) with specialist nursing degree in emergency care. In Swedish.
[14] The Swedish National Association of Ambulance Nurses and The Swedish Society of Nursing, 2012. Competence description for registered nurse (RN) with specialist nursing degree in ambulance care. In Swedish.
[15] Reay G, Smith-MacDonald L, Then KL, Hall M, Rankin JA. Triage emergency nurse decision-making: Incidental findings from a focus group study. Int. Emerg. Nurs. 2020;48:100791.
[16] Faheim SS, Ahmed SS, Aly EF, Hegazy SM. Effect of triage education on nurses' performance in diverse emergency departments. Evid. Based Nurs. Res. 2019;1(2):11.
[17] Janssen MA, van Achterberg T, Adriaansen MJ, Kampshoff CS, Schalk DM, Mintjes-de GJ. Factors influencing the implementation of the guideline triage in emergency departments: a qualitative study. J. Clin. Nurs. 2012;21(3–4):437–47.
[18] Gerdtz MF, Collins M, Chu M, Grant A, Tchernomoroff R, Pollard C, et al. Optimizing triage consistency in Australian emergency departments: the Emergency Triage Education Kit. Emergency Med. Austr. 2008;20(3):250–9.
[19] Australasian College for Emergency Medicine. Policy on the Australasian triage scale. West Melbourne Australia; 2013.
[20] Bullard MJ, Unger B, Spence J, Grafstein E, Group CNW. Revisions to the Canadian emergency department triage and acuity scale (CTAS) adult guidelines. Canadian Journal of Emergency Medicine 2008;10(2):136–42.
[21] Savatmongkorngul S, Yuksen C, Suwattanasilp C, Sawanyawisuth K, Sittichanbuncha Y. Is a mobile emergency severity index (ESI) triage better than the paper ESI? Int. Emerg. Med. 2017;12(8):1273–7.
[22] Mackway-Jones K, Marsden J, Windle J. Emergency triage: Manchester triage group. John Wiley & Sons; 2014.
[23] Government WC. The south african triage scale (SATS): training manual (2012). Western Cape Government (Health) Cape Town; 2012.
[24] Widgren BR, Jourak M. Medical Emergency Triage and Treatment System (METTS): a new protocol in primary triage and secondary priority decision in emergency medicine. J. emerg. Med. 2011;40(6):623–8.
[25] Widgren BR. RETTS - Emergency care directly (in Swedish). 1. uppl. ed. Lund: Lund: Studentlitteratur; 2012.
[26] Pérez N, Nissen L, Nielsen RF, Petersen P, Biering K. The predictive validity of RETTS-HEV as an acuity triage tool in the emergency department of a Danish Regional Hospital. Eur. J. Emerg. Med. 2016;23(1):33–7.
[27] Henning B, Lydersen S, Døllner H. A reliability study of the rapid emergency triage and treatment system for children. Scand. J. Trauma Resuscit. Emerg. Med. 2016;24(1):1–6.
[28] Lampi M, Junker JP, Tabu JS, Berggren P, Jonson CO, Wladis A. Potential benefits of triage for the trauma patient in a Kenyan emergency department. BMC Emerg. Med. 2018;18(1):1–7.
[29] Giri, S., Halvas-Svendsen, T., Rogne, T., Shrestha, S. K., Døllner, H., Solligård, E., & Risnes, K. (2020). Pediatric Patients in a Local Nepali Emergency Department: Presenting Complaints, Triage and Post-Discharge Mortality. Global pediatric health, 7, 2333794X20947926.
[30] Fernandes CM, Tanabe P, Gilboy N, Johnson LA, McNair RS, Rosenau AM, et al. Five-level triage: a report from the ACEP/ENA Five-level Triage Task Force. J. Emerg. Nurs. 2005;31(1):39–50.
[31] Larsson G, Holmén A, Ziegert K. Early prehospital assessment of non-urgent patients and outcomes at the appropriate level of care: A prospective exploratory study. Int. Emerg. Nurs. 2017;32:45–9.
[32] Magnusson C, Herlitz J, Axelsson C. Patient characteristics, triage utilisation, level of care, and outcomes in an unselected adult patient population seen by the emergency medical services: a prospective observational study. BMC Emerg. Med. 2020;20(1):7.
[33] Hinson JS, Martinez DA, Cabral S, George K, Whalen M, Hansoti B, et al. Triage performance in emergency medicine: a systematic review. Ann. Emerg. Med. 2019;74(1):140–52.
[34] Recznik CT, Simko LM. Pediatric triage education: an integrative literature review. Journal of Emergency Nursing. 2018;44(6):605-13. e9.

[35] Gerdtz M, Bucknall TK. Influence of task properties and subjectivity on consistency of triage: a simulation study. J. Adv. Nurs. 2007;58(2):180–90.
[36] Wolf L. Does your staff really "get" initial patient assessment? Assessing competency in triage using simulated patient encounters. J. Emerg. Nurs. 2010;36(4):370–4.
[37] Parenti N, Ferrara L, Reggiani MLB, Sangiorgi D, Lenzi T. Reliability and validity of two four-level emergency triage systems. Eur. J. Emerg. Med. 2009;16(3):115–20.
[38] Parenti N, Manfredi R, Reggiani MLB, Sangiorgi D, Lenzi T. Reliability and validity of an Italian four-level emergency triage system. Emerg. Med. J. 2010;27(7):495–8.
[39] Parenti N, Reggiani MLB, Sangiorgi D, Serventi V, Sarli L. Effect of a triage course on quality of rating triage codes in a group of university nursing students: a before-after observational study. World J. Emerg. Med. 2013;4(1):20.
[40] Acquadro, C., Conway, K., Hareendran, A., Aaronson, N., & European Regulatory Issues and Quality of Life Assessment (ERIQA) Group. (2008). Literature review of methods to translate health-related quality of life questionnaires for use in multinational clinical trials. Value in Health, 11(3), 509-521.
[41] Altman DG. Practical statistics for medical research: CRC press; 1990.
[42] Association WM. World Medical Association Declaration of Helsinki. Ethical principles for medical research involving human subjects. Bull. World Health Organ. 2001;79(4):373.
[43] Boysen GN, Christensson L, Jutengren G, Herlitz J, Sundström BW. Patient trust and patient safety for low-priority patients: a randomized controlled trial pilot study in the prehospital chain of care. Int. Emerg. Nurs. 2019;46:100778.
[44] Bergqvist L-L, Bohlin L, Karlsson M, Pettersson J. Inter-rater reliability of the triage system RETTS: The research and development unit for local health care in Östergötland; 2014. Report No.:2014:14. In Swedish.
[45] Magnusson C, Herlitz J, Karlsson T, Jimenez-Herrera M, Axelsson C. The performance of the EMS triage (RETTS-p) and the agreement between the field assessment and final hospital diagnosis: a prospective observational study among children < 16 years. BMC Pediatr 2019;19(1):500.
[46] Magnusson C, Axelsson C, Nilsson L, Strömsöe A, Munters M, Herlitz J, et al. The final assessment and its association with field assessment in patients who were transported by the emergency medical service. Scand. J. Trauma, Resuscit. Emerg. Med. 2018;26(1):111.
[47] Runciman W, Hibbert P, Thomson R, Van Der Schaaf T, Sherman H, Lewalle P. Towards an International Classification for Patient Safety: key concepts and terms. Int. J. Qual Health Care 2009;21(1):18–26.
[48] Bergs J, Verelst S, Gillet J-B, Vandijck D. Evaluating implementation of the emergency severity index in a Belgian hospital. J. Emerg. Nurs. 2014;40(6):592–7.
[49] Delnavaz S, Hassankhani H, Roshangar F, Dadashzadeh A, Sarbakhsh P, Ghafourifard M, et al. Comparison of scenario based triage education by lecture and role playing on knowledge and practice of nursing students. Nurse Educ. Today 2018;70:54–9.
[50] Uslu Y, Unver V, Karabacak U. Hybrid simulation in triage training. Int. J. Car. Sci. 2019;12(3):1626.
[51] Abelsson A, Rystedt I, Suserud BO, Lindwall L. Learning by simulation in prehospital emergency care–an integrative literature review. Scand. J. Caring Sci. 2016;30(2):234–40.
[52] Jonson C-O, Pettersson J, Rybing J, Nilsson H, Prytz E. Short simulation exercises to improve emergency department nurses' self-efficacy for initial disaster management: Controlled before and after study. Nurse Educ. Today 2017;55:20–5.
[53] Dubovi I. Designing for online computer-based clinical simulations: evaluation of instructional approaches. Nurse Educ. Today 2018;69:67–73.
[54] Atack L, Rankin J, Then K. Effectiveness of a 6-week online course in the Canadian Triage and Acuity Scale for emergency nurses. J. Emerg. Nurs. 2005;31(5):436–41.
[55] Martin A, Davidson CL, Panik A, Buckenmyer C, Delpais P, Ortiz M. An examination of ESI triage scoring accuracy in relationship to ED nursing attitudes and experience. Journal of Emergency Nursing. 2014;40(5):461-8.
[56] Göransson KE, Ehnfors M, Fonteyn ME, Ehrenberg A. Thinking strategies used by Registered Nurses during emergency department triage. J. Adv. Nurs. 2008;61(2):163–72.
[57] Faheim SS, Ahmed SS, Ally FAM, Hegazy MA. Effect of triage education on nurses' performance in diverse emergency departments. Evid. Based Nurs. Res. 2019;1(2).
[58] Linder F, Holmberg L, Eklöf H, Björck M, Juhlin C, Mani K. Better compliance with triage criteria in trauma would reduce costs with maintained patient safety. Eur. J. Emerg. Med. 2019;26(4):283.
[59] Worster A, Sardo A, Eva K, Fernandes CM, Upadhye S. Triage tool inter-rater reliability: a comparison of live versus paper case scenarios. J. Emerg. Nurs. 2007;33(4):319–23.