Modern Triage in the Emergency Department

Michael Christ, Florian Grossmann, Daniela Winter, Roland Bingisser, Elke Platz

SUMMARY

Background: Because the volume of patient admissions to an emergency department (ED) cannot be precisely planned, the available resources may become overwhelmed at times ("crowding"), with resulting risks for patient safety. The aim of this study is to identify modern triage instruments and assess their validity and reliability.

Methods: Review of selected literature retrieved by a search on the terms “emergency department” and “triage.”

Results: Emergency departments around the world use different triage systems to assess the severity of incoming patients’ conditions and assign treatment priorities. Our study identified four such instruments: the Australasian Triage Scale (ATS), the Canadian Triage and Acuity Scale (CTAS), the Manchester Triage System (MTS), and the Emergency Severity Index (ESI). Triage instruments with 5 levels are superior to those with 3 levels in both validity and reliability (p<0.01). Good to very good reliability has been shown for the best-studied instruments, CTAS and ESI (κ-statistics: 0.7 to 0.95), while ATS and MTS have been found to be only moderately reliable (κ-statistics: 0.3 to 0.6). MTS and ESI are both available in German; of these two, only the ESI has been validated in German-speaking countries.

Conclusion: Five-level triage systems are valid and reliable methods for assessment of the severity of incoming patients’ conditions by nursing staff in the emergency department. They should be used in German emergency departments to assign treatment priorities in a structured and dependable fashion.

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The emergency department is the crucial interface between the emergency medical services and the hospital. As reflected in the year-on-year increases in patient numbers, however, emergency departments are increasingly being selected as the route of primary access to the healthcare system (Figure 1) (1). Deficits in preclinical patient guidance have been put forward as a possible explanation for this trend (2).

The volume of admissions to a given emergency department cannot be predicted with any great accuracy, only a certain proportion of the patients have life-endangering or medically urgent conditions (Figure 1) (3), and not all those admitted can be treated immediately or simultaneously. Thus, patients with life-threatening injuries or illnesses need to be reliably identified within minutes of arrival (4). Structured triage systems for emergency department admissions are already in use in the German-speaking countries (3, 4) and the relevant medical societies are calling for their introduction in nations with established hospital emergency services (4, 5).

In the emergency department “triage” refers to the methods used to assess patients’ severity of injury or illness within a short time after their arrival, assign priorities, and transfer each patient to the appropriate place for treatment (5). In our view the term “triage” should be adopted in German-speaking countries in preference to the various German words that have been used, e.g., “Sichtung” and “Ersteinschätzung,” as the latter are not clearly defined concepts. In some European countries, among them Germany and Switzerland, triage is performed by specially trained nursing staff (3–8). The aim of this study is to provide a systematic overview of established instruments for triage in the emergency department and evaluate their validity and reliability.

Methods

Studies were retrieved from the Medline database by a search on the following terms (search date : 5 January 2009): triage AND emergency department (n = 1587); five-level triage (n = 25); Canadian Triage and Acuity Scale (n = 40); National Triage Scale (n = 17); Australasian Triage Scale (n = 30); Manchester Triage System (n = 15); Emergency Severity Index (n = 26). Relevant information was taken from review articles and original
studies. Only articles from peer-reviewed journals were considered (Table, eTable), and only studies with published validity or reliability were then analyzed.

Validity of a triage instrument
A method is described as “valid” if its results agree with the “true” value. With regard to triage systems, the assigned priority level should correspond with the actual degree of urgency. In the absence of a gold standard for the genuine degree of urgency, surrogate markers such as rate of hospital admission, rate of admission to intensive care, mortality rate, and utilization of resources are used to assess validity (5, 9).

Reliability of a triage instrument
The reliability or replicability of the results should be as high as possible; otherwise the method is not sufficiently dependable (5). Ideally, different investigators should come to the same conclusions regarding treatment priority. Reliability is described using the kappa statistic, where $\kappa = 0$ indicates a random result and $\kappa = 1$ shows total agreement between two or more measurements. Agreement is classified as follows: poor ($0.2 < \kappa < 0.4$), satisfactory ($0.4 < \kappa < 0.6$), good ($0.6 < \kappa < 0.8$), and very good ($0.8 < \kappa < 1$) (5). Some studies have used weighted kappa statistics. Because usually only one of these two parameters is reported, the results cannot be directly compared.

Results
Overview of triage instruments
Registration of vital signs alone is not suitable for identification of critically ill patients in the emergency department (10). Therefore various systems are used internationally to determine initial treatment priorities. These range from unstructured classification according to one’s own experience (“best guess” [11]) over instruments such as a three-level “traffic light” system (red: emergency; amber: urgent; green: non-urgent [12]) to four- and five-level scales (13–16). Some of these instruments are just used at one particular institution, so their dependability is insufficiently documented.

Five-level instruments are significantly correlated with resource utilization, rates of admission for inpatient treatment, duration of emergency treatment, and frequency of transfer to intensive care or mortality (14). Comparison of methods revealed that three-level triage systems have insufficient reliability. The interobserver reliability between triage personnel and experts is low ($\kappa = 0.19$ to $0.38$ [5]), while that of the five-level system is significantly higher ($\kappa = 0.68$; $p<0.01$ [17]). We will therefore review the literature on established five-level triage systems.

The principal five-level triage instruments
Australasian Triage Scale
The Australasian Triage Scale (ATS) has been employed in all Australian emergency departments since 1994 (7). Each level of priority has a defined time limit within which evaluation by a doctor should begin (Table). The process data from individual hospitals and for different regions are published on the Internet. Findings on the validity or reliability of this instrument are available, although no prospective assessment of reliability has yet been carried out (Box).

Canadian Triage and Acuity Scale
The Canadian Triage and Acuity Scale (CTAS) is based on the ATS and was developed in the 1990s by emergency physicians in New Brunswick, Canada (15). Since 1997 the parameters of the CTAS have been compulsorily documented by the Canadian Institute of Health Information. As in the ATS, the times from arrival to evaluation by a doctor are recorded.

In the CTAS an extensive list of presenting clinical complaints and symptoms is used to determine the triage level. These include anamnestic parameters associated with high risk, e.g., intoxication, together with clinical signs, vital parameters, and symptoms such as shortness of breath or abdominal pain. Triage must be repeated after a defined waiting time or when there is a change in the patient’s symptoms. The validity and reliability of the CTAS are outstanding (Box), and a modified instrument has been developed for evaluation
of pediatric emergencies (18). The descriptors and modifiers of the CTAS are encapsulated in a software application (www.caep.ca). In rural areas of Canada the triage is sometimes carried out exclusively by specially trained nurses, who then decide whether patients need to be transferred elsewhere for further medical care.

Manchester Triage System

The Manchester Triage System (MTS) is used in emergency departments in Great Britain and, in a modified translation, in German emergency departments (3, 13). The MTS follows a specific approach: the patient’s principal presenting complaints are allocated to one of 52 flowchart diagrams, e.g., head injury or abdominal pain. Key discriminators are defined for each of these diagrams, such as danger to life, pain, or state of consciousness. When a new patient presents to the emergency department the triage nurse assigns their reported complaints to a defined algorithm and then determines the treatment priority with the aid of fixed rules that take account of vital signs. The few studies that have been performed point to satisfactory reliability of this tool (Box) (19).

Emergency Severity Index

The Emergency Severity Index (ESI) is a five-level triage algorithm that was developed in the USA in the late 1990s (20). Treatment priority is decided on the basis of disease severity and the expected resource needs (Figure 2). The triage algorithm consists of four decision points where the trained triage nurse asks specific questions. First, patients with life-threatening conditions (ESI levels 1 and 2) are identified. Unstable patients are typically assigned to ESI triage level 1, e.g., in the presence of hemodynamic or respiratory instability. Patients with (potentially) life-threatening symptoms, e.g., thoracic pain in acute coronary syndrome or loss of consciousness, and also those with severe pain, psychiatric disorders, or states of intoxication, are assigned to triage level 2. The remaining levels (3 to 5) are defined by the expected resource needs and vital signs (Figure 2). Resources in this sense are services such as X-ray and administration of intravenous medication that go beyond physical examination and are necessary to reach a decision on how to proceed (6). Clinical studies show that this instrument also has good validity and reliability in specific groups.
of patients such as children and the elderly (Box). A validated translation of this tool into German has been published by a team from the emergency department of the University Hospital Basel, Switzerland (8).

Other five-level triage instruments
Regional solutions such as the Gruppo Formazione Triage system in Italy (21), the Taiwan Triage Scale (22), the Cape Triage Scale (23), and the Geneva Emergency Triage Scale (16) have been used, and yet other tools have been employed in individual hospitals. Not all of these systems have been described in journals with external peer review. Since some of these methods draw on the above-mentioned triage instruments and some have not been comprehensively evaluated, they will not be discussed further here.

Discussion
Five-level triage instruments are the gold standard in emergency medicine worldwide. The best studied and most widely distributed five-level systems are the ATS, CTAS, MTS, and ESI, all of which possess satisfactory to very good validity and reliability. The MTS and ESI have been translated into German. While the German-
language version of the MTS has not yet been validated, data on the validity and reliability of the ESI in German have been analyzed and the results published (Grossmann FF et al.: Transporting clinical tools to new settings: cultural adaptation and validation of the Emergency Severity Index in German. Ann Emerg Med 2010; in press).

The literature shows that triage of emergency patients by trained nurses using a five-level system has been successfully implemented in English-speaking countries (5). Our own observations demonstrate that such systems can also be used safely by nursing staff in Germany and Switzerland and improve on the quality provided by the subjective assessment widely employed to date. This necessitates rethinking the organization of processes; more emphasis must be placed on interdisciplinary differential diagnosis, risk stratification, and the treatment of acute diseases, and this must be reflected in training. An example is provided by the key symptom of acute loss of consciousness, which can probably be managed more effectively in interdisciplinary fashion, as practiced in English-speaking countries. The introduction of a modern triage system in Australia increased patient safety, improved both the organization of the work of the emergency department staff and their job satisfaction, and reduced the patients’ waiting time as well as the total time they spent in the emergency department ([24] and unpublished personal observations). Moreover, the proportion of patients who leave the emergency department without seeing a doctor because of the long waiting time is lowered significantly, by 50%, thus increasing patient safety (24). It remains to be established to what extent these results can be replicated in Germany.

The role of the five-level triage instruments in the assessment of patients with psychiatric diseases and children has not been analyzed systematically, and in our opinion these tools should not be introduced in the near future, given the specialized management of psychiatric and pediatric emergencies prevalent in the German-speaking countries. In the ESI, patients with acute psychiatric illnesses are assigned to ESI triage level 2, the same level as patients suffering severe pain, on grounds of their high level of distress. In practice, this means that psychiatric patients presenting to interdisciplinary emergency departments must always be treated immediately, whatever the overall workload in the department.

Some triage instruments (CTAS, ATS, MTS) set time limits by when a certain proportion of patients, depending on treatment priority, must have been evaluated by a doctor (Table). The ESI takes a different approach for patients with low priority (ESI level 3 to 5): rather than fixed time limits, the goal is evaluation of these patients as soon as possible depending on current workload. Patients assigned to ESI level 1 must be treated immediately. Patients classified as level 2 receive nursing care straightaway, including continuous monitoring, and evaluation by a doctor must follow within 10 min at the most (6). The time to first contact with a doctor in the emergency department is one of the performance indicators in all triage systems and in some of them is used for benchmarking. In the CTAS the patient’s priority level is re-evaluated after a defined time in order to register any deterioration in status as early as possible (Table). The ESI and ATS suggest that re-triage—which we regard as necessary—be carried out only as and when required. To increase patient safety, in our own emergency departments we enforce re-triage at defined intervals even when using the ESI. The intervals are oriented on the stipulations of the CTAS.

Evaluation of the triage instruments
The five-level triage scales are superior to three-level systems with regard to validity and reliability (12).
Some European societies therefore demand the use of a five-level triage system in emergency departments in which treatment capacity is sometimes exceeded (4). Taking the above-mentioned limitations of methodology into account, the highest numbers of publications refer to the five-level instruments CTAS and ESI, both of which have been the subject of multicenter studies and analyses carried out in Europe. The ATS is also well documented, but published data on the MTS are sparse.

**Five-level triage instruments in German**

Among the triage instruments described herein, the MTS has been documented in detail in German. In our view, however, problems arise from the fact that the German translation does not make it quite clear why the original algorithm has been modified. For example, there are only 50 instead of 52 flowchart diagrams, the defined reaction times have been changed, and various other modifications, e.g., in evaluation of pain, have been introduced. Moreover, concepts such as “hot adult” and “young pain,” though defined in the book (13), are unaccustomed in German and therefore may constitute sources of error. The MTS is widely used in Germany, but there are no published data on the validity and reliability of the German version.

In the meantime a study has been conducted on the validity and reliability of the German translation of the ESI (8). Initial analyses confirm high validity and reliability of this instrument in German (Grossmann FF et al.: Transporting clinical tools to new settings: cultural adaptation and validation of the Emergency Severity Index in German. Ann Emerg Med 2010; in press). Because the training of nurses varies internationally, one might assume that triage instruments developed in English-speaking countries require modification and adaptation to circumstances in Germany. However, our experience with the implementation of the ESI in the emergency departments of Nuremberg Hospital, Germany and the University Hospital Basel, Switzerland shows that this triage instrument can be adopted without modification and safely applied by nursing staff trained in Germany. The systematic data acquired in the course of triage yield information on the severity of illness of patients presenting to German emergency departments (Figure 1); this is important not only for epidemiological purposes but also for health policy and economic analyses and prognoses.

**Implementation and quality management**

The implementation of a structured triage system in an emergency department is associated with a transitional phase and requires careful planning involving all parties concerned, including the nursing and medical staff. Besides the development of a training program, the consequences for patient flow, the hospital information system, and the workflow of the interprofessional team must be considered. Realistically, a modern triage instrument should be able to be implemented within 9 to 12 months (6). Our own experience shows that any instrument that is implemented has to be regularly evaluated and quality improvement measures developed jointly by the members of the team. Case discussions are suggested (6). Another possibility is practice on an interactive triage simulator, as done at the University Hospital Geneva, Switzerland (16).

**Synopsis**

The introduction of structured triage by specially trained nursing staff in the emergency department helps to accurately identify patients whose lives are endangered, especially at times of insufficient treatment capacity. Five-level triage systems are therefore recommended by national and international societies for emergency medicine (4, 5). If it has been decided to implement a triage system, an instrument should be selected for which validity and reliability has been demonstrated—ideally in the language of the country concerned. Apart from correct identification of patients who require urgent medical care, such instruments enable estimation and planning of resources (6).

**Conflict of interest statement**

The authors declare that no conflict of interest exists according to the guidelines of the International Committee of Medical Journal Editors.

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**REFERENCES**

Because the volume of patient admissions cannot be precisely planned, an emergency department may become overcrowded, so that severely ill and less ill patients are competing for the available resources.

The goal of modern triage in the emergency department is to ascertain the severity of illness of emergency patients in a structured way, establish treatment priorities, and assign the patients to the appropriate place for treatment.

Five-level triage instruments are the gold standard in emergency medicine. The Australasian Triage Scale, the Canadian Triage and Acuity Scale, the Manchester Triage System, and the Emergency Severity Index are all validated instruments and are the most widely used systems.

The Manchester Triage System and the Emergency Severity Index have been translated into German and are already being used by trained nurses in some emergency departments in the German-speaking countries.

Validated five-level triage systems should be introduced to emergency departments in the German-speaking countries in order to ensure high patient safety, especially when there is heavy pressure on resources.
Modern Triage in the Emergency Department

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eREFERENCES

e13. e7.
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e23. e7.
## Published validity and reliability of the five-level triage scales listed in Table 1

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<th>Goal</th>
<th>(\kappa)-statistic</th>
<th>Remarks</th>
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<td>n. s.</td>
<td>Retrospective analysis of instrument validity in 91 patients transferred to an intensive care unit: 67% of patients were correctly assigned to MTS 1/2, 18 patients were incorrectly assigned to a lower priority level, 5 of 6 patients deteriorated during their stay in the emergency department, 1 patient was not correctly identified.</td>
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<td><strong>MTS</strong></td>
<td>Assessment of interrater reliability of MTS and NTS/ATS</td>
<td>0.31–0.63</td>
<td>Adequate to good reliability; four emergency physicians retrospectively matched their triage decisions to 50 selected case files, using first ATS, then MTS</td>
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<td><strong>MTS</strong></td>
<td>Assessment of validity in acute coronary syndrome</td>
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<td><strong>MTS</strong></td>
<td>Assessment of validity in pediatric emergency department (&lt;16 years)</td>
<td>n. s.</td>
<td>Validity of MTS was evaluated in a representative sample (1065 of 18 469 pediatric emergency patients). MTS level was compared with resource utilization, inpatient admission rate, and a predefined reference classification: only 63% (sensitivity) of the patients identified by an expert panel as emergencies or very urgent (reference classification) were assessed correctly by triage nurses using MTS (specificity 73%). Under-triage occurred in 15%, over-triage in 40% of patients. The authors suggest modification of MTS for use in children, in order to attain higher instrument validity.</td>
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<td><strong>MTS</strong></td>
<td>Validity of MTS in children (&lt;16 years)</td>
<td>n. s.</td>
<td>A total of 13 554 children underwent computer-assisted classification by MTS in a Dutch emergency department: 34% of the triages corresponded with the reference (vital parameters, diagnoses, etc.), 54% of the children were over-triaged, 12% under-triaged. The authors conclude that the MTS has moderate validity in children presenting to an emergency department; assessment of children represents a challenge.</td>
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<td><strong>MTS</strong></td>
<td>Assessment of validity and reliability</td>
<td>0.62 (w)</td>
<td>Prospective evaluation of 50 patient scenarios by triage nurses in two Dutch emergency departments, re-evaluation by the same nurses 19 days later. Gold standard provided by MTS experts. Test-retest reliability = 0.75; sensitivity for high priority 53.2%; high rate of under-triage in older patients (25.3%).</td>
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<td><strong>NTS/ATS</strong></td>
<td>Assessment of interrater reliability of NTS/ATS</td>
<td>n. s.</td>
<td>No (\kappa)-statistic was calculated: 115 nurses evaluated 110 case scenarios. Agreement within one level of the scale was achieved in 86% of cases.</td>
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<td><strong>NTS/ATS</strong></td>
<td>Assessment of interrater reliability of NTS/ATS</td>
<td>0.25</td>
<td>Adequate reliability; 108 nurses evaluated 20 case scenarios.</td>
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<td><strong>NTS/ATS</strong></td>
<td>Assessment of interrater reliability of MTS and NTS/ATS</td>
<td>0.27–0.53</td>
<td>Adequate to satisfactory interrater reliability (see above)</td>
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<td><strong>ATS</strong></td>
<td>Assessment of validity</td>
<td>n. s.</td>
<td>Characterization of ATS validity in a pilot study of 3650 emergency patients at a Belgian university hospital: 4.2%, 24.4%, 39.2%, 28.0% and 4.1% of patients were assigned to triage categories I, II, III, IV and V respectively. Higher triage categories correlated significantly with admission rate ((p&lt;0.001)). Regarding relative frequency of key symptoms and admission rate, the Belgian cohort agreed well with the data from an Australian reference cohort.</td>
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<tr>
<td><strong>ATS</strong></td>
<td>Assessment of validity</td>
<td>n. s.</td>
<td>Comparison of mortality data from three rural Australian hospitals with published data from large hospitals in Victoria: overall mortality in the three rural hospitals was lower than the published data; there were distinct differences from the published data, with significantly higher rates of mortality and admission for patients classified as ATS 3 ((p&lt;0.05)).</td>
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<tr>
<td><strong>ATS</strong></td>
<td>Assessment of interrater reliability</td>
<td>0.42/0.56</td>
<td>Fourteen written descriptions of case scenarios and 14 computer-displayed scenarios with photographs were evaluated by 167 nurses. Evaluation of the scenarios led to better agreement.</td>
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<td><strong>ATS</strong></td>
<td>Assessment of reliability in psychiatric patients</td>
<td>n. s.</td>
<td>Assessment of instrument reliability from video scenarios of psychiatric patients depending on workload in the emergency department. There was only 53% to 66% agreement in triage evaluation. Conclusion: ATS is inadequate for identification of such patients, especially at busy times.</td>
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<tr>
<td><strong>CTAS</strong></td>
<td>Assessment of interrater reliability</td>
<td>0.80</td>
<td>Very good reliability; nine nurses and eight doctors triaged 50 case scenarios selected from genuine triage decisions (ten cases per triage level).</td>
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<td><strong>CTAS</strong></td>
<td>Assessment of interrater reliability in first-time users of CTAS</td>
<td>0.77 (w)</td>
<td>Good reliability; 20 people (5 doctors, 5 nurses, 10 from the emergency rescue services) evaluated 41 case scenarios selected randomly from among 50 published scenarios ((13)).</td>
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<td><strong>CTAS</strong></td>
<td>Assessment of reliability of CTAS instrument</td>
<td>0.91 (w)</td>
<td>After a refresher course for experienced nurses, the CTAS showed outstanding reliability ((200) case scenarios).</td>
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<td><strong>CTAS</strong></td>
<td>Assessment of interrater reliability</td>
<td>0.75 (w)</td>
<td>Fifteen nurses evaluated 266 patients with the aid of computer-assisted CTAS triage. Reliability was good: the instrument is suitable for benchmarking and other comparisons.</td>
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<td>ESI (vers. 1)</td>
<td>Assessment of interrater reliability and validity</td>
<td>0.80</td>
<td>In an emergency department that originally used a three-level triage system, an emergency physician and a nurse (authors of the study) prospectively evaluated the ESI classification in 351 real case records. The agreement between these two raters was calculated; the hospitalization rate was significantly correlated with the ESI level.</td>
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<td>ESI (vers. 1)</td>
<td>Implementation of ESI in two emergency departments; assessment of validity and interrater reliability</td>
<td>0.73</td>
<td>Good reliability. The ESI instrument was implemented in two university hospital emergency departments: two authors (219 real triage decisions) re-evaluated the triage classification; reliability was calculated from the evaluation by the original triage personnel and the authors' re-evaluation; validity could be demonstrated by the correlation between the patients' hospitalization rate and the resource utilization. The specialty instructed nurses evaluated the ESI tool as simpler and better than the three-level scale they had used previously.</td>
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<td>ESI (vers. 1)</td>
<td>Association of ESI level and 6-month mortality</td>
<td>n. s.</td>
<td>The 6-month mortality of 202 emergency patients was significantly associated with the ESI triage level assigned: I, 32%; II, 14%; III, 17%; IV/V, 0%.</td>
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<td>ESI (vers. 1)</td>
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<td>ESI (vers. 3)</td>
<td>Assessment of reliability</td>
<td>0.89 (w)</td>
<td>After nurses experienced in CTAS triage had undergone brief training, the ESI instrument showed outstanding reliability (200 case scenarios).</td>
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<tr>
<td>ESI (vers. 3)</td>
<td>Assessment of reliability</td>
<td>0.89 (w)</td>
<td>The reliability of the instrument was determined in hospitals other than those where it was originally developed. Excellent reliability was demonstrated. The assigned ESI level correlated with the overall admission rate and the rate of admission to the intensive care unit. Only 2% of the ESI level 3 patients—and none of the ESI level 4/5 patients—had to be transferred to intensive care.</td>
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<tr>
<td>ESI (vers. 3)</td>
<td>Assessment of validity</td>
<td>n. s.</td>
<td>Correlation with resource utilization and length of stay in the emergency department was found in 403 emergency patients. There was no correlation with the inpatient admission rate.</td>
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<td>ESI (vers. 3)</td>
<td>Assessment of validity and reliability in children</td>
<td>0.82 (w)</td>
<td>Prospective initial assessment of pediatric emergency patients: agreement was excellent, and the triage level was significantly correlated with inpatient admission rate, length of stay in the emergency department, and resource utilization.</td>
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<td>Assessment of validity between ESI und Taiwan Triage System</td>
<td>n. s.</td>
<td>Compared with the Taiwan Triage System, the ESI instrument permitted more accurate initial assessment of the 3172 patients analyzed with regard to medical urgency, length of stay in the emergency department, and inpatient admission rate.</td>
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<td>ESI (vers. 3)</td>
<td>Assessment of validity between ESI and CTAS</td>
<td>n. s.</td>
<td>The association of prospectively assigned ESI and CTAS levels with 1) resource utilization, 2) hospital admission, and 3) hospital mortality was evaluated in 486 patients. The strongest correlation was between ESI classification and resource utilization (–0.54), the weakest correlation between CTAS classification and mortality (–0.16). No difference was found between the two instruments with regard to any of the prospectively defined parameters. (34)</td>
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<td>ESI (vers. 3)</td>
<td>Validity of triage algorithm in geriatric patients</td>
<td>n. s.</td>
<td>In 929 patients over the age of 65 years, triage level was significantly associated with hospitalization rate (p&lt;0.001), length of stay in the emergency department (p&lt;0.001), resource utilization (Spearman’s correlation R= –0.683), and 1-year mortality (Kaplan-Meier analysis, p&lt;0.001). (35)</td>
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<tr>
<td>ESI (vers. 3)</td>
<td>Assessment of validity</td>
<td>n. s.</td>
<td>Prospective evaluation of the ESI instrument in 1832 self-presenting emergency patients (&gt;14 years) in a Norwegian teaching hospital. Resource utilization, inpatient admission rate, and need for consultation with a specialist correlated significantly with ESI classification. (36)</td>
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