Chapter 1. Introduction to the Emergency Severity Index: A Research-Based Triage Tool

Standardization of Triage Acuity in the United States

The purpose of triage in the emergency department (ED) is to prioritize incoming patients and to identify those who cannot wait to be seen. The triage nurse performs a brief, focused assessment and assigns the patient a triage acuity level, which is a proxy measure of how long an individual patient can safely wait for a medical screening examination and treatment. In 2008 there were 123.8 million visits to U.S. emergency departments (Centers for Disease Control and Prevention, 2008, tables 1, 4). Of those visits, only 18% of patients were seen within 15 minutes, leaving the majority of patients waiting in the waiting room.

The Institute of Medicine (IOM) published the landmark report, “The Future of Emergency Care in the United States,” and described the worsening crisis of crowding that occurs daily in most emergency departments (Institute of Medicine, 2006). With more patients waiting longer in the waiting room, the accuracy of the triage acuity level is even more critical. Under-categorization (under-triage) leaves the patient at risk for deterioration while waiting. Over-categorization (over-triage) uses scarce resources, limiting availability of an open ED bed for another patient who may require immediate care. And rapid, accurate triage of the patient is important for successful ED operations. Triage acuity ratings are useful data that can be used to describe and benchmark the overall acuity of an individual EDs’ case mix. This is possible only when the ED is using a reliable and valid triage system, and when every patient, regardless of mode of arrival or location of triage (i.e. at the bedside) is assigned a triage level (Welch & Davidson, 2010). By having this information, difficult and important questions such as, “Which EDs see the sickest patients?” and “How does patient acuity affect ED overcrowding?” can then be answered. There is also growing interest in the establishment of standards for triage acuity and other ED data elements in the United States to support clinical care, ED surveillance, benchmarking, and research activities (Barthell, Coonan, Finnell, Pollock, & Cochrane, 2004; Gilboy, Travers, & Wuerz, 1999; Haas et al., 2008; Handler et al., 2004; National Center for Injury Prevention and Control, 1997).

Historically, EDs in the United States did not use standardized triage acuity rating systems. Since 2000, there has been a trend toward standardization of triage acuity scales that have five levels (e.g., 1-resuscitation, 2-emergent, 3-urgent, 4-less urgent, 5-nonurgent). The Emergency Nurses Association (ENA) and the American College of Emergency Physicians (ACEP) formed a Joint Triage Five Level Task Force in 2002 to review the literature and make a recommendation for EDs throughout the United States regarding which triage system should be used. Prior to this task force work, there were a variety of triage acuity systems in use in the United States, dominated by three-level scales (e.g., 1-emergent, 2-urgent, 3-nonurgent). The following position statement was approved in 2003 by the Board of Directors of both organizations: “ACEP and ENA believe that quality of patient care would benefit from implementing a standardized emergency department (ED) triage scale and acuity categorization process. Based on expert consensus of currently available evidence, ACEP and ENA support the adoption of a reliable, valid five-level triage scale” (American College of Emergency Physicians, 2010; Emergency Nurses Association, 2003). The task force published a second paper in 2005 and specifically recommended EDs use either the Emergency Severity Index (ESI) or Canadian Triage and Acuity Scale (CTAS) (Fernandes et al., 2005). Both ESI and CTAS have established reliability and validity. In 2010 the ACEP revised the original statement: “The American College of Emergency Physicians (ACEP) and the Emergency Nurses Association (ENA) believe that the quality of patient care benefits from implementing a standardized emergency department (ED) triage scale and acuity categorization process. Based on expert consensus of currently available evidence, ACEP and ENA support the adoption of a reliable, valid five-level triage scale such as the Emergency Severity Index (ESI)” (ACEP, 2010). Following the adoption of this position statement, the number of EDs using three-level triage systems has decreased, and the number of EDs using the five-level ESI triage system has increased significantly (McHugh & Tanabe, 2011).

Some hospitals continue to use other triage systems. In 2009, the American Hospital Association reported the following survey data in which hospitals reported which triage system they used: ESI (57%), 3-level (25%), 4-level (10%), 5-level systems other
than ESI (6%), 2-level or other triage system (1%), no triage (1%) (McHugh & Tanabe, 2011). The Centers for Disease Control and Prevention National Center for Health Statistics reports national level data regarding ED visits (Niska, Bhuiya, & Xu, 2010). The report now categorizes arrival acuity as five levels based on how urgently patients need to be seen by the physician or healthcare provider and includes the following categories: immediate (immediately), emergent (1-14 minutes), urgent (15-60 minutes), semi-urgent (1-2 hours), and non-urgent (2-24 hours). While this time-based categorization system has not been validated, it provides national-level data of acuity case mix upon presentation.

**History of the Emergency Severity Index**

The ESI is a five-level triage scale developed by ED physicians Richard Wuerz and David Eitel in the U. S. (Gilboy, Travers, & Wuerz, 1999; Wuerz, Milne, Eitel, Travers, & Gilboy, 2000). Wuerz and Eitel believed that a principal role for an emergency department triage instrument is to facilitate the prioritization of patients based on the urgency of treatment for the patients’ conditions. The triage nurse determines priority by posing the question, "Who should be seen first?" Wuerz and Eitel realized, however, that when more than one top priority patient presents at the same time, the operating question becomes, "How long can each patient safely wait?"

The ESI was developed around a new conceptual model of ED triage. In addition to asking which patient should be seen first, triage nurses use the ESI to also consider what resources are necessary to move the patient to a final disposition (admission, discharge, or transfer). The ESI retains the traditional foundation of initially evaluating patient urgency, and then seeks to maximize patient streaming: getting the right patient to the right resources at the right place and the right time.

Version 1 of the ESI was originally implemented at two university-based EDs in 1999. In 2000, the ESI was revised with input from ED clinicians to include pediatric patient triage criteria, and then version 2 was implemented in five additional hospitals (including non-university teaching and community settings). Based on feedback from nurses and physicians using the ESI at these sites, along with the best available scientific evidence, the ESI was further refined in 2001 as version 3 (Wuerz et al., 2001). Limitations in ESI levels 1 and 2 criteria were noted in version 3. Tanabe et al, conducted a prospective research study of 571 ESI level-2 patients at five hospitals. Twenty percent of level-2 patients received immediate, life-saving interventions. The study team concluded that such patients would benefit from being classified as ESI level 1. The ESI Research Team revised ESI level 1 criteria accordingly, resulting in ESI version 4, the most current version of the triage algorithm (Tanabe et al., 2005), which is included in this Implementation Manual.

Emergency physicians and nurses in the United States and Canada have conducted several research studies in which the reliability and validity of the ESI have been assessed. Like the Australasian, Canadian, and United Kingdom scales, ESI triage has five levels. ESI is different in both its conceptual approach and practical application. The underlying assumption of the triage scales from Australia, Canada, and the United Kingdom is that the purpose of triage is to determine how long the patient can wait for care in the ED. Clear definitions of time to physician evaluation are an integral part of both algorithms. This represents a major difference between ESI and the CTAS and the Australasian Triage Scale (ATS). *The ESI does not define expected time intervals to physician evaluation.*

The ESI is unique in that it also, for less acute patients, requires the triage nurse to anticipate expected resource needs (e.g., diagnostic tests and procedures), in addition to assessing acuity. The ESI triage levels are outlined in Figure 1-1. The process of categorizing ED patients using the ESI will be described in detail in subsequent chapters. Briefly, acuity judgments are addressed first and are based on the stability of the patient's vital functions, the likelihood of an immediate life or organ threat, or high risk presentation. For patients determined not to be at risk of high acuity and deemed “stable,” expected resource needs are addressed based on the experienced triage nurse's prediction of the resources needed to move the patient to an appropriate disposition from the ED. Resource needs can range from none to two or more; however, the triage nurse never estimates beyond two defined resources.

**Research on the Emergency Severity Index**

In order for a triage system to be widely adopted and used, it must have excellent reliability and validity. Researchers have focused on the evaluation
of these constructs. (Pedhazur & Schmelkin, 1991; Waltz, Strickland, & Lenz, 1991). Reliability is the consistency, or agreement, among those using a rating system. Two types of reliability pertain to ED triage acuity ratings. Inter-rater reliability is a measure of reproducibility: will two different nurses rate the same patient with the same triage acuity level? Intra-rater reliability is an indication of whether the same nurse, over time, will rate the same patient with the same acuity level. Validity is the accuracy of the rating system and assesses how well the system measures what it is intended to measure. The validity of acuity levels is an indication of whether or not, for example, the level of “non-urgent” is an accurate assessment of the lack of urgency or acuity of an ED patient’s problem. Validity assessments of triage use proxy measures of acuity that have included admission rates, resource utilization, and 6-month mortality. If many patients with low acuity triage levels are admitted to the hospital, the triage system is not valid. The same would be true for very high acuity levels. If many high acuity patients were discharged home, the triage system is most likely not valid.

In a pilot study of ESI version 1 ratings for 493 triage encounters at two Boston hospitals in 1998, researchers found that the system was both valid and reliable (Wuerz et al., 2000). The patients were triaged simultaneously by the triage nurse using the traditional three-level scale and by the research nurse who used version 1 of the ESI. After this triage, an investigator triaged the patients again using the ESI. The investigator was blinded to the research nurse’s ESI rating, and used only the written triage note to make the triage decision. Triage levels were strongly associated with resources used in the ED and with outcomes such as hospitalization. Higher acuity patients (ESI levels 1 and 2) consumed more resources and were more likely to be admitted to the hospital than those with lower acuity ratings (ESI levels 4 and 5). Inter-rater reliability between the research nurse and the investigator was found to be good, with 77 percent exact agreements and 22 percent within one triage level.

The reliability of the ESI has been evaluated in several studies, using the kappa statistic to measure inter-rater reliability. Results using kappa statistics can range from 0 (no agreement) to 1 (perfect agreement). At one of the two original ESI sites, a study was conducted to compare the reliability of triage ratings of a three-level scale with the ESI version 1. (Travers, Waller, Bowling, Flowers, & Tintinalli, 2002). Reliability improved from an inconsistent level for the three-level system (weighted kappa of 0.53) to an acceptable level for the five-level ESI (weighted kappa of 0.68).

In another study, researchers examined the reliability and validity of ESI version 2 during and after implementation of the system into triage practice at seven hospitals in the Northeast and Southeast. During the ESI triage education program, more than 200 triage nurses at the seven sites were asked to rate 40 case studies using the ESI (Eitel, Travers, Rosenau, Gilboy, & Wuerz, 2003). The study results indicated substantial inter-rater reliability with kappa statistics ranging from 0.70 to 0.80. Three hundred eighty-six triage decisions on actual patients were also evaluated and found to have high inter-rater reliability, with weighted kappa statistics ranging from 0.69 to 0.87. In another study at a Midwestern, urban ED, researchers evaluated the reliability of the ESI version 3 for 403 actual patient triages and found a kappa kappa statistic of 0.89 (Tanabe, Gimbel, Yarnold, Kyriacou, & Adams, 2004).

Researchers have also compared inter-rater reliability of the ESI triage system with the CTAS (Worster et al., 2004). Ten Canadian nurses were randomly assigned to initial ESI version 3 or CTAS refresher training, and then rated 200 case studies with the ESI or CTAS, respectively. Both groups had excellent inter-rater reliability, with kappas of 0.89 (ESI) and 0.91 (CTAS).

The validity of the ESI has been evaluated by examination of outcomes for several thousand patients. The studies found consistent, strong correlations of the ESI with hospitalization, ED length of stay, and mortality (Eitel et al., 2003; Tanabe et al., 2004; Wuerz, 2001; Wuerz et al., 2001). The ESI also has been found to have moderate correlations with physician evaluation and management codes and nursing workload measures (Travers et al., 2002). The ESI has been shown to facilitate meaningful comparisons of case mix between hospitals. A stratified random sample of 200 patients was selected from each of the seven initial ESI hospitals, and case mix was compared (Eitel et al., 2003). As expected, there was a higher percentage of high acuity patients at the tertiary care centers, compared with a higher percentage of low resource patients at the community hospitals. In a survey of nursing staff at the two original university teaching hospitals, responses to the implementation of the ESI were positive (Wuerz et al., 2001). The nurses reported that the ESI was easier to use and more useful in prioritizing patients for treatment than the former three-level systems in use at the two sites.
The performance of ESI in pediatric patients has also been evaluated. Travers et al (2009) have conducted the largest evaluation of ESI in pediatric patients (Travers, Waller, Katznelson, & Agar, 2009). Reliability was evaluated using both written case scenarios and actual patient triages at five different sites. The validity of ESI was assessed in a group of 1173 pediatric patients using hospital admission, resource consumption and ED length of stay. Inter-rater reliability for written case scenarios was 0.77 and 0.57 for live triages, suggesting room for improvement in educational training of ED nurses. Validity of triage categories in pediatric patients was established with outcome measures of hospitalization, resource utilization, and ED length of stay. The outcomes from this study suggested the need for additional education of ED nurses in the area of overall pediatric triage, which led to the inclusion of a pediatric chapter in this new edition of the ESI handbook. In a separate investigation, 16 ED physicians and 17 ED nurses scored 20 pediatric written case scenarios (Duran, Breecher, Walmley, Attia, & Loiselle, 2009). Overall inter-rater reliability was excellent (weighted kappa=.93).

Several studies have evaluated the performance of ESI with an elderly population. In a study of 929 patients age 65 or older with a total of 1,087 ED visits over a 1-month period in 2004, ED resource utilization, ED length of stay, hospital admission, and 1-year survival were assessed. The ESI algorithm performed well in all areas (Baumann & Strout, 2007). In a separate investigation of 782 patients > 65 years of age, the accuracy of ESI to identify elderly patients requiring a life-saving intervention was investigated (Platts-Mills et al., 2010). While specificity was high (99%), sensitivity was poor (42%). This suggests further evaluation of the performance of ESI in elderly patients may be warranted.

The ESI has been translated into several languages and evaluated for reliability and validity. Good inter- and intra-rater reliability (weighted kappas of .73 and .65) was found when evaluated in the Netherlands (Storm-Versloot, Ubbink, Chin a Choi, & Luitse, 2009). The ESI was translated into German and researchers found excellent inter-rater reliability (k=0.985) and good validity with comparisons of ESI triage levels and number of resources used, hospitalization, and death (Grossman et al, 2011). In a separate evaluation in an urban European country, validity of the ESI categories was established with the number of resources used and proportion of patients requiring hospital admission (Elshove-Bolk, van Rijswijck, Simons, van Vugt, 2007). Van der Wulp and colleagues compared validity of predicting admission between the ESI and Manchester triage systems. Both systems demonstrated good predictive ability with ESI scoring higher (van der Wulp, Schrijvers, van Stel, 2009). Finally, validity assessed by hospitalization was compared between ESI and the Taiwan Triage System (TTS). ESI was better able to discriminate patient acuity and hospitalization when compared with the TTS (Chi & Huang, 2006).

**Benefits of the Emergency Severity Index**

The ESI has been implemented by hospitals in different regions of the country, by university and community hospitals, and by teaching and nonteaching sites. ED clinicians, managers and researchers at those sites have identified several benefits of ESI triage over conventional three-level scales. In 2008, the National Opinion Research Center conducted a survey of 935 persons who requested ESI training materials from the Agency for Healthcare Research and Quality. Respondents were asked to rate their satisfaction with ESI as a triage tool as well as to compare ESI with other triage tools. Overall, ratings of satisfaction were high; respondents reported ESI was simple to use, reduced the subjectivity of the triage decision, and was more accurate than other triage systems (Friedman, Singer, Infante, Oppenheimer, West, & Siegel, in press).

One benefit of the ESI is the rapid identification of patients that need immediate attention. The focus of ESI triage is on quick sorting of patients in the setting of constrained resources. ESI triage is a rapid sorting into five groups with clinically meaningful differences in projected resource needs and, therefore, in associated operational needs. Use of the ESI for this rapid sorting can lead to improved flow of patients through the ED. For example, level 1 and 2 patients can be taken directly to the treatment area for rapid evaluation and treatment, while lower acuity patients can safely wait to be seen.

Other benefits of the ESI include determination of which patients do not need to be seen in the main ED and those who could safely and more efficiently be seen in a fast-track or urgent care area. For example, in many hospitals, the triage policy stipulates that all ESI level-4 and level-5 patients can be sent to either the medical fast track or minor trauma areas of the ED. The triage policy may also allow for some level-3 patients to be sent to urgent care (UC), such as patients needing simple migraine treatments.
headache treatment. ESI level-3 patients triaged to UC and all patients sent to the acute area from UC for more serious conditions are monitored in the quality improvement program. Nurses using the ESI have reported that the tool facilitates communication of patient acuity more effectively than the former three-level triage scales used at the sites (Wuerz et al., 2001). For example, the triage nurse can tell the charge nurse, "I need a bed for a level-2 patient," and through this common language, the charge nurse understands what is needed without a detailed explanation of the patient by the triage nurse. Hospital administrators can use the case mix in real time to help make decisions regarding the need for additional resources or possibly diverting ambulance arrivals. If a waiting room has multiple level-2 patients with long waits, the hospital may need to develop a plan for the disposition of those patients who are waiting for an inpatient bed and occupying space in the ED.

The ESI also has been used as the foundation for ED policies that address specific populations. For example, the psychiatric service at one site is expected to provide consults for level-2 and level-3 patients with psychiatric complaints within 30 minutes of notification and for level-4 and level-5 patients within 1 hour. At another site, the ESI has been incorporated into a policy for patients greater than 20 weeks pregnant who present to the ED. Patients rated at ESI levels 1 and 2 are treated in the ED by emergency medicine with an obstetrical consult. Those rated 3, 4, or 5 are triaged to the labor and delivery area of the hospital.

Standardization of ED triage acuity data using the ESI is beneficial for secondary uses of ED data. For example, ED crowding researchers have incorporated the ESI into metrics for measuring and predicting ED crowding (Bernstein, Verghese, Leung, Lunney, Perez, 2003). Wider adoption of the ESI by U.S. hospitals could lead to the establishment of a true standard for triage acuity assessment, which will facilitate benchmarking, public health surveillance, and research.

References


Friedman Singer R, Infante AA, Oppenheimer CC, West CA, Siegel B (in press). The use of and satisfaction with the Emergency Severity Index. JEN.

Chapter 1. Introduction to the Emergency Severity Index: A Research-Based Triage Tools


McHugh M, Tanabe P (2011, June). The Emergency Severity Index is the most commonly used triage system in the U.S. Presented at the Society of Academic Emergency Medicine Annual Meeting, Boston, MA.


