

The Long and Winding Triage Road

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ANNALS CASE

The Dark Ages

Imagine a poor, conscripted foot soldier, fighting for Napoleon's army circa the late 1700s. During a gruesome battle, he shatters his femur. He cannot walk and consequently is left in the battlefield. Despite having injuries that are treatable, even by 18th-century standards, he has been abandoned, helpless on the field. If lucky, he might receive medical help the following day...but only if his army won...and only after a long wait because triage back then was determined by military rank, family wealth, and ability to quickly return to battle.^{1,2}

At the turn of the 18th century, Napoleon's military surgeon, Dominique Jean Larrey, implemented a battlefield triage system based on severity of injury and urgency needed for medical care, regardless of rank or allegiance. Examples of emergency injuries requiring immediate intervention included hemorrhage, cardiac tamponade, sucking chest wounds, and hemothorax. An urgent injury, such as a gravely injured limb, could wait a few hours for treatment, in this case debridement and amputation. Soldiers with nonurgent injuries were minimally wounded and could go by horse themselves to the nearest hospital.^{3,4} These 3 tenets of triage (emergency, urgent, and nonurgent) persisted in acute care settings both on and off the battlefield for the next 200 years.⁵

RINGING IN THE NEW MILLENNIUM WITH A NEW TRIAGE SYSTEM

In 2000, Wuerz et al⁶ again revolutionized patient triage by introducing the 5-level triage system known as the

Emergency Severity Index (ESI), which most of us use today. Previous triage models addressed how rapidly the patient needed medical care; however, the Wuerz model also factored in the patient's expected resource use. To illustrate the benefit of ESI versus the traditional 3-tier model, consider a 25-year-old man with normal vital signs, presenting for a wound check of an incision and drainage. He would be considered nonurgent in the 3-tier model and an ESI 5 by the Wuerz method, which may sound like 2 different ways of saying the same thing, but it's not. In an emergency department (ED) with triage ESI, all ESI 5 patients by definition can consult with a provider alone without a need for nursing care. On the other hand, in the traditional triage model, a nonurgent patient is lumped with the rest of the low-acuity patients, many of whom will require nursing care or additional resources. He or she must wait for the provider to perform more time-consuming procedures such as simple closed reductions and pelvic examinations. This slows patient throughput times and allocates nursing staff away from patients who need them.

Today, ESI has gone mainstream, accounting for 72% of ED triage systems in the United States.⁷ Its popularity is understandable. First, in 2003 the American College of Emergency Physicians and the Emergency Nurses Association jointly endorsed the switch to a 5-tier model.⁸ Second, it's a simple algorithm with a free training manual online.⁹ Finally, compared with its predecessors, it is superior in predicting resource allocation and hospital admissions—and certainly better than waiting it out on the battlefield!⁶

SO ESI IS PERFECT AND WE ARE DONE! NOT QUITE

Despite the great interrater reliability at its test sites, this success was not replicated elsewhere.^{7,10-13} In fact, one study in Switzerland found its nurses' ESI assignment was correct only 59.6% of the time; 13.6% of patients were overtriaged and, most concerning, 26.8% of patients were undertriaged.¹² That is a scary statistic, considering that in today's crowded EDs, ESI level should expedite sick

patients out of the waiting room and to the intervention they need, such as a cardiac catheterization or operation.

Another major problem with ESI is that, despite its 5 different acuity levels, nearly half of all ED patients are assigned an ESI level of 3.⁷ EDs are stuck with this large, undifferentiated, midacuity group all vying for the same resources. It fails to meaningfully stratify which of these patients needs more urgent versus less urgent care. ESI 3 patients on average have the longest time to disposition because they often require the most evaluation, and if the ESI 3 resources are bottlenecked, they could take even longer!¹⁴ (Think about all of those “dispo pending CT scan or troponin” sign-outs.)

The ESI level assigned at triage can also introduce a potentially dangerous bias. It is easy to fall into the trap of assuming a patient is “not sick” according to the triage nurse’s initial classification. This bias can result in a higher threshold for tests and imaging, and underprioritization of these diagnostic tests. Based on this initial diagnostic trajectory, critical diagnoses may be incorrectly excluded from the differential.

“ESI 2.0”

Many busy urban EDs have moved to ESI 2.0, which incorporates front-end physician triage, split flow, and vertical flow. Front-end triage involves an emergency clinician’s briefly assessing every patient who comes in the door to reduce the chance of a critical condition’s being missed, as well as initiating the diagnostic evaluation and consultations. Patients can even be discharged directly from this triage area. Split flow separates ESI 3 patients according to variability of care. High-variability patients—for example, with a chief complaint such as “severe headache”—may require many or few resources and do not follow a predictable algorithm. For example, patients with mild headaches not concerning for an acutely dangerous process are anticipated to require only pain medications. Thus, they can be placed in a vertical flow area where patients sit in chairs rather than traditional hospital stretchers, thereby remaining vertical. Low-variability patients are expected to follow a simple work flow.

National data demonstrate that institutions using ESI 2.0 have significantly decreased ED crowding and patient door-to-discharge time.¹⁵⁻¹⁷ Downsides to this model include lower patient satisfaction scores and issues of patient privacy for patients whose entire care is completed in a vertical flow area, which in many cases is an ED lobby.¹⁸ Additionally, smaller or single-coverage EDs may find it impractical to pay for a dedicated triage physician.

CAN TECHNOLOGY HELP US?

ESI has its foibles, and split flow has its quirks. Although some critics are ready to scrap ESI altogether, what other options do we have?

Nowadays, robots can clean our floors, money has been digitalized, watches can make calls, and nearly everything is “smart,” from refrigerators to telephones. If only Silicon Valley types could turn their attention toward our struggling triage conundrum!

Enter Levine et al,¹¹ with their publication on machine-learning-based electronic triage. Their data show that predictive analytics from an electronic triage system (ETS) can more evenly distribute ESI 3 patients and better predict those requiring critical care or emergency procedures. This makes it easier to send patients to the appropriate treatment area and safely streamline resource use.

ETSs use complex algorithms, which take into account patient characteristics such as age, sex, chief complaint, vital signs, arrival mode, and relevant medical history to assign them into 1 of 5 triage tiers. Unlike ESI, which has been validated to stratify patients according to resource use and hospital admission rates, ETS stratifies its patients according to predictions of critical and time-sensitive outcomes, such as mortality, ICU admission, or cardiac catheterization, as well as by surrogate markers of critical outcomes, such as likelihood of elevated troponin and lactate levels.^{6,7,11} These markers seem more consistent with an emergency clinician’s priorities.

ETS can be adapted to unique practice settings, using predictive analytics to recognize patterns of data without being explicitly programmed. For example, a hospital’s unique ICU admission criteria or protocol for medical versus operative management of appendicitis can be customized and integrated into the ETS algorithm.

The ETS triaging score is done autonomously by a machine, which may sound a little *2001: A Space Odyssey*, but just remember that about 90% of your commercial flight time is spent in autopilot these days.¹⁹ ETS is not meant to replace the triage provider; it spits out a triage-level score that triagers can override according to patient appearance, clinical history, and gestalt, just like they do with the current ESI system. Although in general the automation of medicine may be alarming (what’s next? robot interns?), it does seem that electronic triaging represents progress. Like it or not, it might be helping EDs in the not-so-distant future.... “O brave new world, That has such people [or robots] in’t!”

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