WHITE PAPER

TriageGO System Helps Johns Hopkins ED by Assigning 56% More Patients to Low-Acuity Status

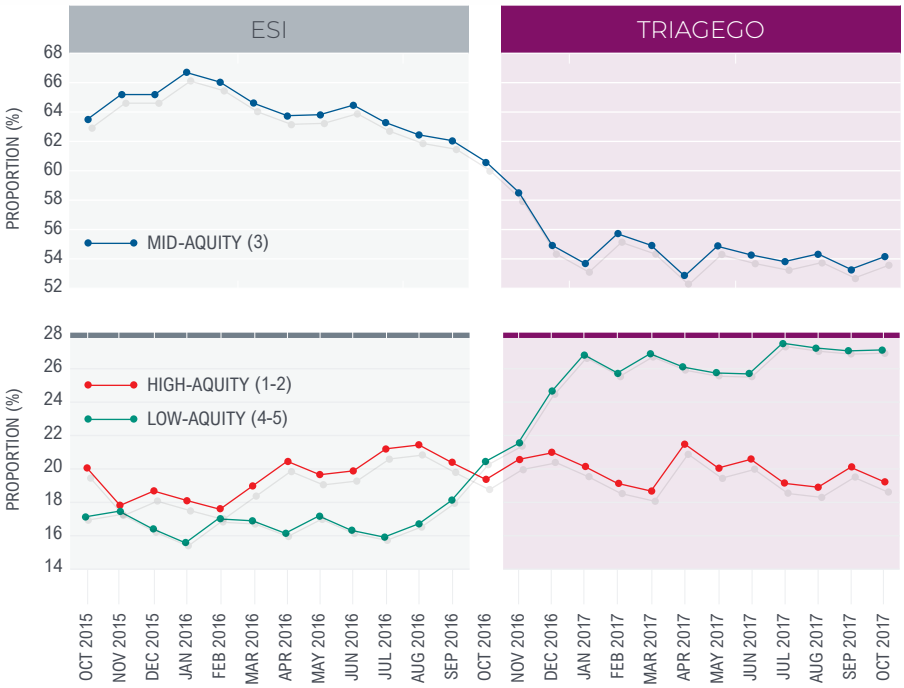
Risk-based Triage Improves Differentiation and Provides Patients with Faster Care

Summary

A major contributor to the overcrowding problems pervasive in emergency departments (EDs) nationwide are the patient flow bottlenecks caused by the lack of clarity and specificity in the commonly used Emergency Severity Index (ESI) triage system. In the U.S., as many as 60-70% of all ED patients are triaged to ESI Level 3; the mid-point of a 5-Level system where a projected clinical course is uncertain.[1,7,9] Because so many patients are assigned to ambiguous Level 3 and are undifferentiated, this can obstruct patient flow in the ED. High-risk patients requiring immediate care are less-likely to be identified and expedited early[9,10], and alternatively low-risk patients may not benefit from separate work-streams (e.g. fast-track) designed for rapid minor care and disposition[11].

After the ED at Johns Hopkins integrated the TriageGO decision-support tool into its Electronic Health Record (EHR) system and their ED's routine triage workflow, the average number of patients designated low-acuity (Level 4 or 5) increased 56% while the number of Level 3 patients dropped by more than 15%[1,12]. This resulted in overall decreases in time-to-care and faster access for critically ill patients[1,12].

› **Figure 1**



JOHNS HOPKINS MEDICINE

› Headquartered in Baltimore, Maryland, Johns Hopkins Medicine unites physicians and scientists of the Johns Hopkins University School of Medicine with the organizations, health professionals and facilities of the Johns Hopkins Hospital and Health System.

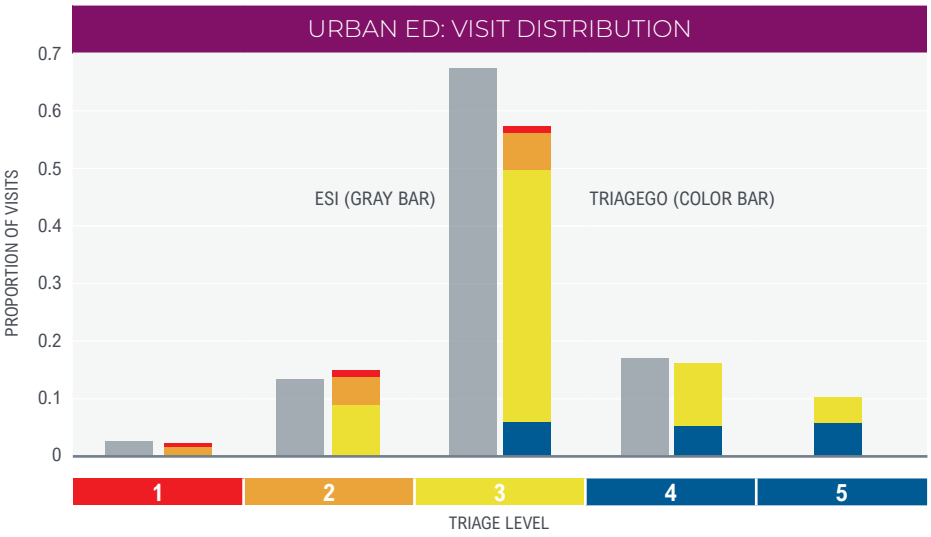
› Its Department of Emergency Medicine is recognized nationally and internationally for excellence in patient care and innovative programs. One of its innovations, TriageGO, has become an integral part of the triage process in EDs at the Johns Hopkins Hospital, Johns Hopkins Bayview Medical Center and Howard County General Hospital, which combined see almost 200,000 visits annually.

BECKMAN COULTER

Overcrowding: A Pervasive and Pernicious "Canary in the Coal Mine"

As more people require emergency care and hospitals often have few if any available inpatient beds, most EDs have excessively long wait times for patients awaiting treatment decisions, as well as a backlog of admitted patients boarding in the ED until a bed becomes available. In fact, overcrowding has been called "the sentinel canary in the coal mine," a key indicator reflective of a dysfunctional health system.

- Between 1997 and 2016, ED visits nationwide increased by more than 60% to about 146 million.
- ED visits in the last two decades have strongly outpaced population growth.[3]
- Overcrowding is a persistent norm. As far back as 2007, greater than 90% of U.S. EDs were stressed beyond the breaking point at least some of the time.
- The evidence is incontrovertible: ED overcrowding leads to significant patient harm, including morbidity and mortality related to consequential delays of treatment for both high- and low-acuity patients and increased adverse (and preventable) events.



› **Figure 2.** The targeted acuity distribution for TriageGo (right; colored bar) compared with the original ESI distribution (left; gray bar).

Despite mounting evidence of its adverse impact, overcrowding continues to worsen. Recent data from the Association of Academic Chairs of Emergency Medicine (AACEM) hospitals shows that the proportion of ED patient boarding at least 8 hours rose nearly 130% (from 7.0% to 16.0%,) from 2012 to 2019.[2]

Background

The Emergency Severity Index (ESI) is a five-level emergency department (ED) triage algorithm that provides clinically relevant stratification of patients into five groups: from 1 (most urgent) to 5 (least urgent) based on acuity and resource needs.[4] It is used by between 80 – 94% of U.S. EDs and influences most decisions on whether a patient will be discharged or admitted.

Numerous studies, including a multisite, retrospective, cross-sectional study of 172,726 ED visits from urban and community EDs[5], have found that an electronic triage system (TriageGO) based on machine learning could more accurately classify ESI level 3 patients and predict the likelihood of acute outcomes. It was developed by the Johns Hopkins Medicine ED, which began using it in 2016.

Before implementing TriageGO, the Johns Hopkins Hospital ED's ESI triage system was assigning 65-70% of patients to Level 3 status.

According to the *ESI Implementation Handbook*, about 30 – 40% of ED patients are expected to be categorized as Level 3. However, observed ESI distributions for U.S. ED visits reported that more than 55%-70% of patients were classified as Level 3. [6,7,9]

The Solution: TriageGO

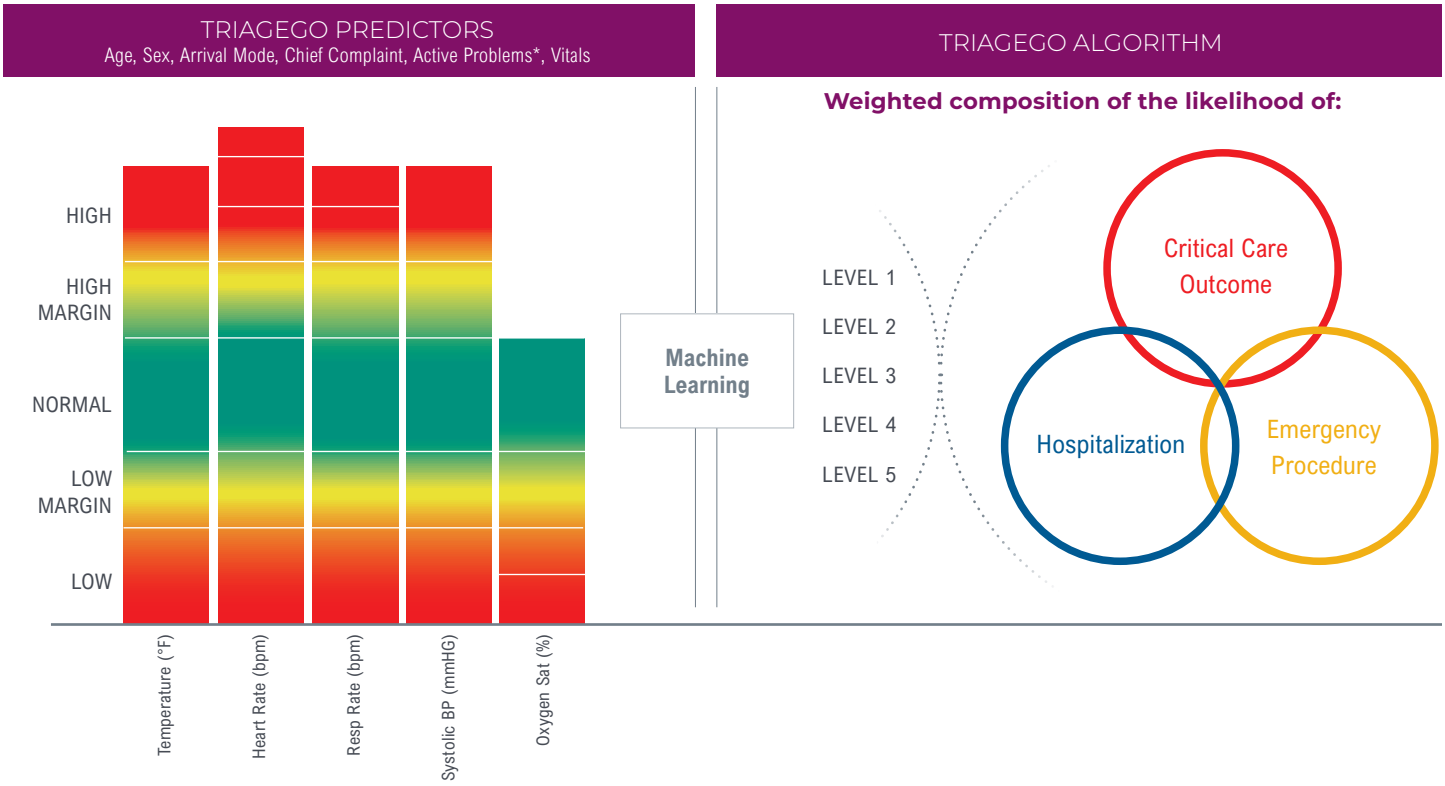
TriageGO has been used by major hospitals systems to triage more than 2 million patients. It is seamlessly integrated into any ED's Electronic Health Record (EHR) system and current triage workflow. Nurses can learn to use it quickly and have immediate access to its recommendation in a patient's EHR at the point-of-care.

With this unique clinical decision-support tool, EDs can:

- boost ED operations by improving patient differentiation at triage.
- speed time-to-emergent-care for high-risk patients.
- increase the number of low-risk patients directed to more efficient "fast-track" care pathways.
- reduce decision time on whether a patient will be discharged or admitted.

How it Works

TriageGO applies machine learning and predictive analytics to stratify a patient's risk of emergent care and/or hospitalization in order to recommend an acuity level. Research shows that it can help reduce the population of Level 3 patients (who account for most of the long wait times) by as much as 15 -20%.



*Specific cutoff values have been removed from this illustration for proprietary reasons

› **Figure 3.** TriageGo Predictors and algorithm with an example ED risk profile. The risk profile translates predicted, probabilities of critical care, emergency, surgery, and hospitalization outcomes to TriageGo levels.

Outcome definitions: critical care outcome was compositely defined as either in-hospital, mortality or direct admission to an ICU; emergency procedure outcome was defined as any surgical procedure, including cardiac catheterization, that occurred in an operating room within 12 hours of ED disposition; and hospitalization outcome was defined as any admission to an inpatient care site, including ward, or direct transfer to an external acute care hospital.

- TriageGO scans readily available patient data — the presenting complaint, vital signs and demographic information – as well as his/her active medical history in the EHR.
- It also instantly scans the records of hundreds of thousands of the facility's anonymized ED visits, which it combines with insights derived from millions of additional ED visits across other facilities using TriageGO.
- All this information is then used to make a triage level recommendation (1-5) based on the patient's clinical risks, not just anticipated resources needed for care.
- The triage nurse accesses the TriageGO recommendation in the acuity section of the EHR, which also includes brief notes about the reason(s) for the recommendation.

Importantly, TriageGO is not meant to replace nurses' critical role in the triage process but to give them more timely, robust evidence-based information to guide and accelerate clinical decisions. It recommends but does not assign patients' acuity levels, which must be done by the examining nurse. If nurses disagree with the recommendation, they can input the reason why, and this information is used to improve TriageGo's predictive capabilities.

Results and Benefits

- **Improved patient flow.** Since the ED at Johns Hopkins Hospital began using TriageGO, the percentage of patients assigned to Level 3 fell from 65 -70% to approximately 55% — a more than 15% reduction in the number of patients with an ambiguous course of care.
- **Reduced patient wait times.** Fewer ESI Level 3 patients meant shorter wait times for every patient, faster access to care for more high-risk patients and faster discharges for low-risk patients.
  - **Accelerate door-to-admit-decision by 35 minutes**[1]
  - **Speed time-to-emergent-care for high-risk patients by an average of 61-82 minutes**[1,2]
- **Increased bed capacity and reduced costs.** Because TriageGo minimized the Level 3 bottlenecks, the hospital's ED gained between 8,500+ bed hours a year, which meant cost savings of $450,000 (based on 60,000 annual visits).[1,13,14]

ED resources throughout the country are "extremely strained," says Gabe Kelen, director of the Department of Emergency Medicine at Johns Hopkins. He goes on to say, ""This is all about patient safety, and this system [TriageGO] tremendously improves patient safety."

- **Improved consistency in triaging scores.** In a multi-national study, the inter-rater reliability (i.e. the agreement between subjective ratings by multiple raters) of nurse-assigned ESI scores was less than 60%. With TriageGO, the EDs at Johns Hopkins achieved inter-rater reliability scores between 70% and 85%. This indicates that nurses' TriageGO ratings for the same patient are more consistent, which reduces variability in the ED's triage practices.

"With TriageGO, our nurses only think about the likelihood of admission rather than the work that would be required to care for our patients. Our patients assigned to level 2 are now sicker and getting cared for much faster. And we're fast-tracking more patients, which means they're not using beds that sicker patients need."

SOPHIA HENRY, MS RN, ED NURSE COORDINATOR AND TRIAGE COORDINATOR, JOHNS HOPKINS ADULT EMERGENCY DEPARTMENT

Lessons Learned

- Accuracy in designating appropriate acuity levels plays a critically important role in improving ED throughput and providing clinically appropriate care.
- Although having the recommended triage scores embedded in patients' EHRs makes integrating TriageGO into workflow practices simple and easy, here are some tips from the Johns Hopkins ED for facilitating a smooth rollout:
    - Get leadership and nurse champions involved from the start so they can understand the scope and impact of the ED problem and help other nurses understand the need for change.
    - Have a timeline prominently visible to all that shows all the project work being done, including what's happening behind the scenes.
    - Continue end-user education and follow-up after the system goes live to address the staff's questions such as why TriageGO recommended a certain acuity.
    - Collect and share data with nursing and ED leadership to show improvements in acuity distribution, agreement rates and reductions in door-to-decision times.
- A risk-based approach to assigning acuity designations has several advantages over a resource-based system such as the ESI, .including reduced subjectivity, reduced variability, increased throughput, and finally, more reliable detection of patients at risk of a critical-care outcome[1,2].

"By facilitating faster decisions, TriageGO has helped alleviate stress-inducing uncertainty for our ED staff and patients. For experienced nurses, it guides them in making objective decisions, even when fatigued. And for the novice triage nurse, it builds their confidence and keeps them thinking about the reasons why TriageGO recommended triage levels."

SOPHIA HENRY, MS RN, ED NURSE COORDINATOR AND TRIAGE COORDINATOR, JOHNS HOPKINS ADULT EMERGENCY DEPARTMENT

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For more information on TriageGO visit

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