2020 ESO EMS INDEX:

INSIGHTS AND BEST PRACTICES FOR EMS AGENCIES

AUTHORS

BRENT MYERS, MD CHIEF MEDICAL OFFICER, ESO
ALLEN JOHNSON, CHIEF PRODUCT OFFICER, ESO
REMLE CROWE, PHD, NREMT, RESEARCH SCIENTIST & PERFORMANCE IMPROVEMENT MANAGER, ESO
ANTONIO FERNANDEZ, PHD, NRP, RESEARCH SCIENTIST, ESO
We live in a dynamic, ever-changing world and Emergency Medical Services (EMS) is no stranger to evolution. Over the last few years, we've seen changing landscapes that could have a significant impact on EMS – from Emergency Triage, Treat, and Transport (ET3), to upcoming rule changes by the Drug Enforcement Administration (DEA), to the robust use of data for true system-wide performance improvement and research activities versus mere compliance with data submission requirements. And, in emerging news, the healthcare community is contending with the spread of coronavirus. The need to adapt is essential.

Now, in our third full year of producing the EMS Index, we are also evolving, adjusting, and refining our work to provide richer insights and new perspectives. Additionally, we continue to bring new metrics into the discussion aimed to further quality improvement.

For the 2020 Index, we will again look at four core clinical metrics: stroke assessment performance, end-tidal carbon dioxide (EtCO₂) after advanced airway procedure, 12-lead performance for adults with chest pain, and aspirin administration for adults with chest pain. We will also examine two key surveillance measures: percent of patients suffering from overdose and influenza-like illness (ILI).

One refinement to our methods is normalizing all measures around 9-1-1 calls versus all encounters. We feel this provides a more cohesive description around emergent calls (versus mixing results with the smaller subset of interfacility transports or scheduled transports). Additionally, for EtCO₂ we dig a little deeper and look at the total number of value recorded. Based on national quality and safety measure discussions, a new metric we are adding to the 2020 EMS Index is lights and siren use for scene-to-hospital transports.

As always, the appropriate metrics for evaluating the success of your EMS organization will vary depending upon a number of factors including, but not limited to, the size of the population served and the geographic location. However, we believe an objective look at aggregate data across the United States can provide a starting point or benchmark that you can use to evaluate performance compared to your peers.

The purpose of this Index is to serve as a point of reference for EMS organizations to identify which areas are in alignment and which areas represent opportunity for improvement, more intensive local monitoring, or at least further assessment and evaluation. This quantitative approach to measuring performance gives EMS organizations a framework to continually refine tactics, improve efficiency and outcomes, and allocate resources appropriately. To that end, here are some of the questions we hope the 2020 ESO EMS Index will help you ask and investigate using your own data:

**HERE ARE THE QUESTIONS WE SET OUT TO ANSWER LAST YEAR AND LOOK TO CONTINUE ANSWERING THIS YEAR**

- Is my organization performing in-line with other organizations around the country when it comes to responding to certain events, such as stroke identification and assessment?
- Are we constantly keeping patients safe from unrecognized misplaced airway devices by using continuous waveform capnography?
- How often are we performing 12-lead EKGs for adult patients experiencing classic signs of STEMI, like chest pain? What about when it comes to less common signs like syncope or generalized weakness?
- Are we above or below the national average when it comes to responding to overdose events?
- Are we properly equipped to handle a spike in flu-related calls (especially in light of the coronavirus)?
- Are we practicing judicious use of lights and siren?
- What are the best practices for each metric in this Index and how can I make sure we are following these at our organization?
The Index uses ESO data from more than 1,360 agencies and departments across the country and represents 6.85 million 9-1-1 calls (out of 8.46 million total calls) between January 1, 2019 – December 31, 2019.

This index is retrospective and looks at aggregate data from 2019. There are no universal rules designed around these measures. The purpose of the Index is to be informative and directional, but it is not intended to be a scientific study. Nor is it intended to be comprehensive in nature. We hope it serves as a body of literature that adds to the discussion and conversation around best practices and quality improvement efforts to improve positive patient outcomes.

*The denominator for the 2020 Index included 9-1-1 call types only. The 2020 Overdose as a percent of all encounters is 2.05%
KEY FINDINGS

The 2020 ESO EMS Index looks at 6.85 million 9-1-1 calls (out of 8.46 million total calls) from January 1, 2019 – December 31, 2019. We are pleased to report nearly every one of the metrics measured in last year’s Index showed relative improvement, with stroke assessment performance showing the biggest percentage point jump. At a macro level, the data revealed the following:

When looking at documented stroke assessment completion rate, we continue to see improvements across the board.

**INCREASED NEARLY 7%**

jump from 2018 to 2019 (from 65% to 72%).

The data show that EMS providers are either completing the stroke assessment more frequently or documenting the assessment more regularly after a primary impression of stroke is identified. The Cincinnati Prehospital Stroke Scale (CPSS) was most commonly used.

There is still work to be done, especially around successful administration and appropriate documentation of aspirin for patients with chest pain, with 2019 numbers only one percentage point above 2018 numbers (52%).

While 12-lead performance among patients ages 35 and older with chest pain increased in 2019 (83%) over 2018 (77%), there is still room for improvement.

**OVERALL 87%**

of patients were transported without lights and siren. The rate of lights and siren transports varied across agencies.

In 98% of cases with 9-1-1 calls only, EtCO₂ monitoring was initiated after advanced airway insertion (96% in 2018). Additionally, of those calls with an EtCO₂ value recorded, 88% had more than one value recorded.

Patients with suspected overdose accounted for 2.45% of 9-1-1 calls and 98% of all calls in 2019, which is significantly above 2018 at 1.65%. Overdose encounters accounting for nearly 58% more encounters than stroke as a primary impression.

Flu-like primary impressions accounted for 1% of all encounters, with the majority coming in the months of January and February. The 2018-2019 influenza season was a moderate severity season.

9-1-1 ACTIVATIONS

6.85M

Records in 2019

In 98% of cases with 9-1-1 calls only, EtCO₂ monitoring was initiated after advanced airway insertion (96% in 2018). Additionally, of those calls with an EtCO₂ value recorded, 88% had more than one value recorded.

Patients with suspected overdose accounted for 2.45% of 9-1-1 calls (and 2.05% of all calls) in 2019, which is significantly above 2018 at 1.65%. Overdose encounters accounting for nearly 58% more encounters than stroke as a primary impression.

Flu-like primary impressions accounted for 1% of all encounters, with the majority coming in the months of January and February. The 2018-2019 influenza season was a moderate severity season.
The stroke assessment performance metric looks at how many patients with an EMS primary impression of stroke received a formal stroke assessment as part of a 9-1-1 call (not interfacility transfers and other types of encounters) that was appropriately documented. The conversation around stroke continues to evolve, and it is becoming increasingly important to not only identify a stroke, but to determine the severity of the stroke using a validated, complete, formal stroke assessment. The treatment options and hospital destinations for patients will vary depending on a number of factors, including the severity as determined by a formalized assessment.

Chart 2 below shows there were 92,094 calls where the EMS provider impression included stroke. Of those encounters, 67,228 were given a complete stroke assessment (or documented a stroke assessment) – or 72%. Stroke encounters were 1% of all 9-1-1 calls.

According to the Centers for Disease Control and Prevention (CDC), stroke kills about 140,000 Americans each year, and every 40 seconds, someone experiences a stroke. Stroke costs the United States about $34 billion each year in medical expenses, lost wages, etc. In addition to being one of the leading causes of death, stroke is also one of the leading causes of long-term disability and the leading preventable cause of disability, according to the American Stroke Association.

Early identification of patients possibly experiencing stroke promotes better outcomes by getting the patient to the right treatment faster. With the expansion of endovascular treatment windows, there is greater reason to focus on appropriate EMS screening and severity scoring such that patient routing for endovascular treatment can be accomplished consistent with the local community’s plan.
Make sure to document Last Known Well Time or Time of Onset. This information plays an important role in determining a patient’s treatment. Recently, a research investigation showed that this field is missing in about 30% of records with a primary impression of stroke.

The availability of enhanced care at specialized centers, including mechanical thrombectomy, makes formal stroke assessment and stroke severity assessment all the more important.

A recent study comparing the predictive performance of the CPSS, RACE, LAMS and VAN for detecting large vessel occlusion stroke showed similar results across scales. While there is no clear best prehospital stroke severity scale, performing a complete assessment using a validated tool is key. The choice of screen will depend on local and agency factors including considerations related to implementation and training costs.

Stroke assessment in patients with sudden onset of even vague neurological systems can be the difference between a successful or unsuccessful patient outcome.

Monitor stroke assessment rates for patients with sudden onset of neurological symptoms and provide performance feedback often by reinforcing outstanding performance and encouraging low performers.

Properly document stroke assessment using EHR tools that yield discrete data to enable retrospective analysis of the predictive value of these tools.

Look at how your organization is performing with stroke assessment completion rates for patients with suspected stroke against the data in this Index. Is your agency above the average? Below the average?
The use of continuous waveform EtCO\textsubscript{2} monitoring confirms proper placement, can alert the provider of accidental dislodgement, and the second-by-second waveform provides definitive proof that the tube remained in place during the encounter.

Chart 3 shows that in 98% of advanced airway cases, EMS providers followed this best practice of measuring and recording EtCO\textsubscript{2}. There were 45,540 cases in our analysis, with only 910 (2%) not receiving EtCO\textsubscript{2} monitoring in some form. Records with an advanced airway procedure performed accounted for 0.7% of all 9-1-1 calls.

A recent article brought national attention to field intubations performed by EMS when it identified nearly a dozen patients who arrived at the hospital with misplaced breathing tubes over a period of three years in a single state.

In patient safety terms, unrecognized esophageal intubation is considered a “never event” because this error should not happen under any circumstance. Proper placement of an advanced airway device should always be confirmed through the measurement of end-tidal carbon dioxide (EtCO\textsubscript{2}). Continuous waveform capnography is the most reliable method for verification of advanced airway placement. In addition to confirming proper advanced airway placement, continuous EtCO\textsubscript{2} monitoring can alert the provider of accidental dislodgement and the second-by-second waveform provides definitive evidence that the tube remained in place throughout an encounter. This simple tool has a nearly 100% sensitivity and 100% specificity for detecting esophageal intubations.

The data also show that when an EtCO\textsubscript{2} value was recorded, the median number of readings obtained was 5.
Follow the gold standard for advanced airway placement confirmation using continuous waveform capnography.

Monitor compliance and recognize outstanding performers while coaching poor performers.

Recognize and teach the value of EtCO₂ monitoring for a variety of patient presentations including, but not limited to, detection of ROSC during resuscitation, bronchospasm due to asthma, diabetic ketoacidosis, sepsis, and intracranial hemorrhage. Continuous waveform capnography provides a real-time breath-to-breath look at the patient’s condition, whereas pulse oximetry can have a delay or lag of about 5 minutes.
The 12-Lead Performance metric looks at how often a 12-lead electrocardiogram (EKG) was performed and appropriately documented after non-traumatic chest pain was identified as an EMS provider impression in patients over the age of 35. Overall, records with an EMS provider impression of non-traumatic chest pain among adults 35 or older represented 3.5% of all 9-1-1 records.

Chart 4 below shows that in 2019 there were 277,639 9-1-1 calls involving adult patients experiencing non-traumatic chest pain, and a 12-lead EKG was used 83% of the time. You may note improvement compared with previous indicies. We have refined the metric to include only 9-1-1 responses, which more closely mirrors the 12-lead requirement.

INSIGHT

The role of EMS in the system-of-care for patients experiencing STEMI is critical. The 12-lead EKG is an important diagnostic tool that can help get the patient to the right care fast and improve the likelihood of a positive outcome. EMS activation of the cardiac catheterization lab speeds the time to diagnosis and reperfusion therapy.

Multiple studies show that door-to-balloon time can be reduced by as much as 30 minutes with minimal impact on transport time, highlighting the value of the 12-lead EKG for all adult patients exhibiting non-traumatic chest pain.
Monitor 12-lead performance and time to 12-lead for patients experiencing non-traumatic chest pain.

Consider expanding performance metrics to include less common signs and symptoms associated with STEMI, including syncope, abdominal pain, respiratory distress, altered level of consciousness, and generalized weakness.

Upon identifying a positive 12-lead, immediately notify the receiving hospital to reduce time to Cath Lab activation.

Partner with your local hospital to receive outcome information for all patients with chest pain you transport, as well as patients with hospital-diagnosed STEMI that were missed in the prehospital environment.
The aspirin administration for chest pain metric looks at the number of patients over the age of 35 with a primary impression of non-traumatic chest pain who received aspirin or had a documented aspirin allergy.

Chart 5 shows that in only 53% of the cases, aspirin administration protocol was followed and appropriately documented. This means that in just 144,000 of the 272,100 records where the EMS provider indicated an impression of non-traumatic chest pain, aspirin was administered and documented in a discrete data field.

The CDC identifies heart disease as the number one cause of death in the United States, accounting for more than 610,000 deaths annually (or 25% of all deaths).

Multiple studies have shown early administration of aspirin to be effective in reducing deaths from acute coronary syndrome. One study in particular showed that using aspirin early can reduce deaths by as much as 23%.

The question of whether the 53% of records meeting measure criteria for aspirin administration reflects a clinical care issue or a documentation issue warrants further investigation. In many cases, EMS providers may only document aspirin administration or aspirin taken prior to EMS arrival in the free-text narrative portion of the patient care record. Narrative-only documentation complicates measurement and improvement efforts. Instead, providers should be encouraged to document all aspirin administration, even aspirin taken prior to arrival, in the discrete data fields (in EHR this is in Flowchart-Medications). In the case that a patient has a known aspirin allergy, this should be documented in the discrete patient allergy data field.
**BEST PRACTICE**

Make aspirin administration a focal point for chest pain care and educate crews on the patient benefits.

Monitor protocol compliance and provide performance feedback to crews.

Consider pre-arrival instructions for dispatch-initiated aspirin administration.

Ensure appropriate documentation in discrete data fields whether aspirin was administered by the EMS crew, the patient, a bystander, or other first responders prior to EMS arrival.

**WHY IS ASPIRIN ADMINISTRATION NEGLECTED?**

During 2018, ESO reviewed a random sampling of records from our dataset to identify common causes for failure of the ASA with adult chest pain metric. We determined that three reasons account for nearly 81% of the unsuccessful completions.

**REASON 1**  **NARRATIVE ONLY INCLUSION**

In 30% of cases, ASA was documented in the narrative but not in the flow chart. The medication administration in this case is not queryable and this does not always include route, dose, etc. that are prompted as part of the flow chart treatments.

**REASON 2**  **MISCATEGORIZED**

In nearly 20% of the cases, the chest pain was clearly non-cardiac (e.g., traumatic mechanism) but a primary impression of chest pain was chosen.

**REASON 3**  **NO RECORD**

Unlike stroke where only 4% had no evidence of any type or any portion of stroke screen completion, in 35% of cases of adult chest pain where ASA was indicated based upon the clinical encounter, there was no record of ASA administration whatsoever.

Thus, the performance activities here should focus on two areas: 1) Education regarding the importance of ASA administration whenever there are indications of potential ACS/Chest Pain and 2) Emphasis on appropriate documentation of treatments that have been administered as well as appropriate documentation of precise primary impressions.
The overdose metric looks at the number of patients with an EMS provider impression related to overdose compared to the total number of 9-1-1 calls. Chart 6 shows that of the 6.45 million 9-1-1 calls in our sample, 167,823 had a primary impression related to overdose (or 2.45%) – as a side note, overdose calls were 2.05% of ALL calls in our sample. That’s a significant jump from 2019 Index results (1.65%) - whether looking at a percent of all calls (2.05%) or just 9-1-1 calls (2.45%) and highlights the fact that overdoses continue to be a major public health concern in this country.

Between 1999 and 2016, more than 630,000 people died from drug overdose in the United States. Overdose continues to be a national problem, with more than 70,000 deaths in 2017, according to the CDC.

Additionally, overdoses account for 82% more encounters than stroke as a primary impression. This is a jump from the 2019 Index (40%) and continues in line with what we’ve seen the last couple of years where the proportion of stroke encounters has remained relatively flat while overdose encounters continue to increase.
Monitor incidents in your community and anticipate trends. Look for geographic hotspots in your community (based on data from your ePCR) to create preventative programs in areas with particularly dense activity.

If your ePCR vendor offers extended data collection for opioid cases, make this a validation rule. More data and information on the incident and situational issues related to overdose events will provide valuable insights.

Investigate novel approaches to encourage overdose patients to seek rehabilitation.
The influenza-like illness (ILI) metric looks at the number of patients identified with a primary impression of flu-like illness based on seasonality. For public health surveillance purposes, the CDC/Influenza Division uses a reporting period for each influenza season beginning on calendar week 40 and ending week 39 of the following year. Each reporting week starts on Sunday and ends on the following Saturday.

In alignment with the CDC methodology, the Index examined the proportion of records with flu-like illness during the 2018-2019 influenza season and assigned activity levels. Each week, the proportion of EMS provider impressions related to influenza-like illness is recorded and assigned an activity level. The 10 activity levels represent the number of standard deviations below, at, or above the average during non-influenza weeks of the prior year. Levels 1-5 are considered “minimal or low”, Levels 5-7 are “moderate”, Levels 8-9 are “high” and Level 10 is considered “very high” influenza-like illness activity.

Not surprisingly, we see the biggest jump in flu encounters in the winter months (late December to late February). Chart 6 shows the influenza-like illness EMS provider impression activity levels during each week of the 2018-2019 influenza season.

According to the CDC, up to 20% of the U.S. gets the flu every year, resulting in more than 34 million outpatient visits and 200,000 hospitalizations.

The 2018-2019 season was a moderate severity season. Overall, the Index data reflect the same trends as the CDC surveillance data. Nationally, influenza-like illness activity began increasing in November, peaked during mid-February and returned to below baseline in mid-April.
BE READY FOR THE ANNUAL FLU OUTBREAK, BEGINNING AS EARLY AS AUGUST.

- Arrange for flu vaccines for staff, ideally in the October/November time frame, and encourage vaccinations for family members. The EMS workforce is best prepared to help our communities when their families are well.

- Review your supply availability and place orders of high in-demand items, such as IV fluids and surgical masks.

MONITOR AND COMMUNICATE THE INCIDENCE OF FLU IN THE COMMUNITY AS A VALUABLE SERVICE TO YOUR HEALTHCARE PARTNERS AND COMMUNITY LEADERS. IN ADDITION TO PREPARING YOUR COMMUNITY, THIS IS AN OPPORTUNITY TO DEMONSTRATE THE VALUE OF EMS DATA AND SERVICES.

- Work with your community partners to raise awareness regarding flu precautions. Double down on opportunities to reach high risk populations, such as partnerships with senior centers and preschools.

- During peak flu periods, the workforce naturally experiences higher volumes of sick days, creating staffing challenges. Help your agency and partners plan for staffing shortages with local data. Proactively consider bolstering your agency’s staffing to accommodate for higher volume and/or consider the implications of overtime costs as crew members cover for colleagues’ sick days.
The lights and Sirens (L&S) metric explores the (non)-use of lights and sirens during transport of a patient or patients from the scene to the Emergency Department or other destination. In alignment with the EMS Compass 2.0 measures released by the National EMS Quality Alliance in September of 2019, the use of standard scoring where higher scores indicate better quality, was employed for this measure. This means that we are focusing on the percentage of calls in which lights and sirens were NOT used.

Chart 6 below shows there were 4,438,909 patient transports included in the analysis for this metric.

In the early days of EMS, most agencies used lights and sirens for nearly every call – whether en route to the scene or transporting a patient from the scene. In the spirit of “do no harm,” a number of studies have been conducted and have provided clear evidence regarding the potential negative consequences of “overusing” lights and sirens – including added stress and anxiety on the patient, disrupting normal traffic flow to create an even more congested transport route, noise pollution, and increased risk of ambulance crashes.

According to a 2017 study by the U. S. Department of Transportation National Highway Traffic Safety Administration Office of Emergency Medical Services (OEMS), a rate of L&S use below 5% of 9-1-1 scene responses is likely safe for patients, with some agencies striving for a feasible zero L&S transports.

EMS agencies should carefully analyze the potential time benefits and risks of L&S use in their community.
Create policies and guidelines around judicious L&S use during response and patient transport.

Minimize L&S use to only truly critical situations.

Per the OEMS, agencies should regularly measure their percentage of L&S use during 9-1-1 scene response and patient transport.

Agencies should consider a target usage rate of less than 5% for L&S responses.
CONCLUSION

SO, WHAT DOES THIS MEAN?

Overall, we are seeing a year-over-year improvement in performance and documentation around the key metrics. However, there is room for improvement around stroke assessment, 12-lead EKG, aspirin administration, and lights and siren usage.

STROKE ASSESSMENT (OR DOCUMENTATION OF STROKE ASSESSMENT) JUMPED FROM

- 2018: 65%
- 2019: 72%

This continues to be a great improvement; however, more needs to be done to ensure patients with neurological symptoms are receiving full assessments for presence of stroke and the severity.

12-LEAD EKG IS BEING PERFORMED

83% OF THE TIME

(a slight improvement from 77% in 2018) in encounters where the EMS provider impression included non-traumatic chest pain and the patient was over 35 years of age.

ASPIRIN HAS THE POTENTIAL TO PLAY A CRUCIAL ROLE

in reducing deaths associated with acute coronary syndrome, so a

53%

ASPIRIN ADMINISTRATION AND/OR DOCUMENTATION RATE

is far too low and needs improvement.

LIGHTS AND SIREN USAGE NEEDS TO BE EXPLORED

87% OF PATIENTS

were transported without lights and siren, which signals room for improvement. Further, the proportion of transports without lights and siren varied substantially across agencies, suggesting that organizational, local and even state related factors may have a role in this important safety measure.
METHODOLOGY

The dataset for the ESO EMS Index is real-world, de-identified data, compiled and aggregated from more than 1,365 agencies across the United States that use ESO’s products and services and agreed to have their data used for research purposes. These data are based on 6.45 million anonymized 9-1-1 calls between January 1, 2019 and December 31, 2019, representing a full calendar year.

THERE IS A 95% CONFIDENCE LEVEL IN THE NUMBERS USED IN THIS REPORT WITHIN A 1% +/- RANGE.

OK, NOW WHAT?

Organizations should use this information to understand why metrics are important and which metrics and drivers can have the biggest effect on your organization and the patients you serve. With this Index as a foundation, you can do your own analysis to serve as the basis for other modeling and outcomes.

The metrics shown in this Index are by no means exhaustive. Every organization is unique and has its own strengths, structure, and goals. Because of these attributes, results achieved by one organization may not be attainable by another for a variety of reasons. However, these metrics should provide a foundation to compare your measurements and outcomes to what we are seeing nationally.

TO LEARN HOW ESO PRODUCTS CAN IMPROVE YOUR AGENCY’S ACCESS TO DATA, VISIT

ESO.COM/INDEX
ESO is dedicated to improving community health and safety through the power of data. Since its founding in 2004, the company continues to pioneer innovative, user-friendly software to meet the changing needs of today’s EMS agencies, fire departments, and hospitals. ESO currently serves thousands of customers throughout North America with a broad software portfolio, including the industry-leading ESO Electronic Health Record (EHR), the next generation ePCR; ESO Health Data Exchange (HDE), the first-of-its-kind healthcare interoperability platform; ESO Fire and ESO FIREHOUSE Software for fire departments; and ambulance revenue recovery/billing software.