In early 2018, we launched the ESO EMS Index and looked at national data across five metrics for the previous calendar year: Stroke assessment performance, ETCO₂ after advanced airway procedure, 12-lead performance for adult patients experiencing chest pain, aspirin administration for adult patients experiencing chest pain, and percent of patients suffering from overdose.

We updated the Index in mid-2018 (looking at data from January 1, 2018 – June 30, 2018) and made refinements to the stroke assessment performance measure to account for the additional screening tools being employed. Additionally, we focused this measure only on 9-1-1 patients, and opted not to include interfacility transfers and other run types, to provide a better evaluation of stroke assessment screening practices for patients suspected to be experiencing a stroke in the prehospital setting.

For the 2019 ESO EMS Index, we are continuing to make refinements to the original five metrics, and we are introducing two new metrics: opioid overdose and influenza (flu) surveillance. The opioid metric is a refinement of the previous, more general “overdose” metric. The subset of records indicating a suspected overdose with a primary impression consistent with opioid use is now being trended over time; our data are consistent with other recent reports that suggest opioid-specific overdoses are on the decline, even while the rate of overdoses in general remains fairly steady. Flu is seasonally driven but has a significant impact on resources and communities. For this metric, we will look at when flu season tends to peak and when we start to see a decline in calls for influenza-like illness (ILI). You can see the most current influenza data at eso.com/flu if you are interested in how things are progressing week by week.

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 guidance for where to potentially allocate limited resources.

As always, the appropriate metrics for evaluating the success of your EMS organization will vary depending upon a number of factors, including the size of the population served and geographic location. However, we believe an objective look at aggregate data across the United States can give you a good idea of how you are performing compared to your peers.
The Index uses ESO data from more than 1,200 agencies and departments and represents 7.58 million patient encounters between January 1, 2018 – December 31, 2018. This Index is retrospective and looks at aggregate data from 2018. 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 for each of the measures identified in this Index to improve the health and safety of our communities.

Chart 1 below displays results from the 2018 Index and 2019 Index for five key EMS metrics.

### Key Metrics

- **Stroke Assessment Performance**
- **ETCO₂, after Advanced Airway Procedure**
- **12-Lead Performance in Adult Patients Experiencing Chest Pain**
- **Aspirin Administration in Adult Patients Experiencing Chest Pain**
- **Percent of Patients Suffering from Overdose**
- **Influenza-Like Illness**

### Limitations

This Index is retrospective and looks at aggregate data from 2018. 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 for each of the measures identified in this Index to improve the health and safety of our communities.
KEY FINDINGS

The 2019 ESO EMS Index looks at 7.58 million patient encounters from January 1, 2018 – December 31, 2018. On a positive note, nearly every one of the metrics measured in last year’s Index showed improvement, with the exception of aspirin administration. At a macro level, the data revealed the following:

EMS providers continue to recognize the value of end-tidal CO₂ monitoring after advanced airway placement. In 96.0% of cases, ETCO₂ monitoring was initiated after advanced airway insertion (up a slight bit from 94.5% in 2017).

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

There is still work to be done, especially around successful administration and appropriate documentation of aspirin utilization in patients with chest pain, as this 2018 measure fell slightly below the measure observed in 2017 (55.3%).

Flu-like primary impressions accounted for 1% of all encounters, with the majority coming in the months of January and February. The 2018 flu season was particularly severe and affected all age groups.

Overdose patients accounted for 1.65% of all encounters in 2018, which is exactly the same as 2017 (1.65%). However, overdose continues to represent a public health problem, with overdose encounters accounting for nearly 40% more encounters than stroke as a primary impression. Of those, men accounted for 58.2% and women accounted for 41.8% of overdoses.

While 12-lead performance with adult patients experiencing chest pain increased in 2018 (77.4%) compared to 2017 (75.9%), there is still room for improvement.
The stroke assessment performance metric looks at what proportion of 9-1-1 EMS patient care records (excluding interfacility transfers and other types of encounters) included documentation of a complete stroke screen when the EMS provider’s primary impression indicated stroke. The conversation around stroke continues to evolve, and it is becoming increasingly important to not only identify when a patient is experiencing a stroke, but also to determine the severity of the stroke using a validated, 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 84,006 encounters where the documented primary impression was stroke. Of those encounters, 54,603 included documentation of a complete stroke assessment - or 65.0%. Stroke encounters represented 1.1% of all encounters.

According to the Centers for Disease Control and Prevention (CDC), stroke causes about 140,000 deaths annually. Strokes cost 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 who are likely experiencing a stroke promotes better outcomes by getting the patient to the right facility faster. With the expansion of endovascular treatment windows, there is greater reason to directly transport patients who are experiencing a large vessel occlusion stroke to a facility where endovascular treatment options are available.
Stroke assessment for patients with sudden onset of even vague neurological systems can be the difference between a positive or negative patient outcome.

Enhanced care, including mechanical thrombectomy, makes formal stroke assessment all the more important.

Consider using the stroke assessment for other primary impressions, including sudden onset of neurological or other unexplained symptoms.

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

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.

Look at how your organization is performing with stroke assessment against the data in this Index. Are you above the average? Below the average?

During 2018, ESO reviewed a random sampling of records from our dataset to identify common causes for unsuccessful completion of stroke screen. We determined that two reasons account for nearly 80% of the unsuccessful completions.

**REASON 1**

We found frequent abandonment of the stroke screen when one element of the screen was positive. Not documenting, or worse, not doing the full screen limits the ability to assess the severity of the stroke. By completing and documenting all elements of a stroke screen, field personnel enable substantially stronger research and performance improvement activities.

**REASON 2**

We also found that the stroke screen was frequently only included in the narrative and not on the specialty form. This inhibits the ability to query data and easily make comparisons with in-hospital vs. out-of-hospital stroke findings.

We found that 4% of EMS records with a documented primary impression of stroke contained no documentation of a stroke screen assessment being performed. The emphasis on performance improvement here should focus on completion of the entire stroke screen and utilization of the specialty patient form.
The measurement of exhaled carbon dioxide, referred to as end-tidal CO₂ (ETCO₂) following advanced airway placement, is an industry best practice and should be measured at every agency. The use of ETCO₂ monitoring confirms proper advanced airway placement, can alert the provider of accidental dislodgement, and the second-by-second waveform provides definitive evidence that the tube remained in place during the encounter.

Chart 3 shows that in 96.0% of advanced airway cases, EMS providers are following this ETCO₂ best practice. There were 42,843 cases in our sample, with only 1,713 not receiving ETCO₂ monitoring in some form. ETCO₂ monitoring accounted for 0.6% of all encounters.

According to the American Heart Association, the use of capnography (ETCO₂) is essential for three reasons:

**TO ENSURE THE ADVANCED AIRWAY STAYS IN PLACE**

**TO ASSESS THE QUALITY OF CPR**

**TO PROVIDE AN EARLY INDICATOR OF RETURN OF SPONTANEOUS CIRCULATION (ROSC)**

Measuring and monitoring ETCO₂ levels to ensure they remain within the acceptable range is critical. Moreover, given the need to move patients and the generally more austere environment in the out-of-hospital vs. the in-hospital settings, EMS airways in all types of patients have an increased risk of becoming dislodged. Therefore, even in the absence of the need for cardiac compressions, measurement of ETCO₂ remains essential.
BEST PRACTICE

Follow the gold standard for advanced airway placement and confirmation.

Establish the expectation that if a patient has an advanced airway, ETCO₂ monitoring is in place as well.

Monitor compliance and recognize outstanding performers while coaching poor performers.

Teach crews to monitor ETCO₂ levels during cardiac arrest and for all intubated patients and adjust ventilation rates to optimize outcomes.
The 12-Lead Performance metric looks at how often a 12-lead electrocardiogram (EKG) was performed after non-traumatic chest pain was identified as a primary impression in individuals over the age of 35.

Chart 4 below shows that there were 305,034 encounters with adults experiencing non-traumatic chest pain, and a 12-lead EKG was used 77.4% of the time.

At the risk of stating the obvious, HEARTe describes a 12-lead EKG as an important tool in clinical decision making and can provide a wealth of information that helps healthcare providers quickly assess the magnitude of a coronary event – information such as identifying potentially life-threatening arrhythmias and the acute effects of a pulmonary embolus. According to the American Heart Association, EMS activation of the cardiac cath lab speeds the time to diagnosis and reperfusion therapy.

Multiple studies show that door-to-balloon time can be reduced – in one study 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 adult patients experiencing non-traumatic chest pain.

Consider expanding performance metrics to include other patients that should receive 12-lead EKGs, including those experiencing abdominal pain, respiratory distress, altered level of consciousness, and general weakness.

Partner with your local hospital to receive outcome information for all chest pain patients experiencing chest pain you transport, especially any cases with suspected STEMI or cases where STEMI was missed.
The aspirin administration for adults experiencing 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 52.3% of the cases, aspirin administration protocol was followed (whether aspirin was administered, whether aspirin administration was documented, or whether an aspirin allergy was documented). This means that in approximately 142,544 of the 272,338 “primary impression of chest pain” cases, aspirin was either administered and/or documented. These cases represent 3.5% of all encounters.

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

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).
**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 if aspirin was administered by a patient, bystander, or first responders prior to EMS arrival.

**WHY IS ASPIRIN ADMINISTRATION PERFORMANCE LOW?**

During 2018, ESO reviewed a random sampling of records 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, aspirin was documented in the narrative but not in the EHR discrete data field for medication administered. The medication administration in this case is not queryable and does not always include route, dose, and other key information that is prompted through the discrete data fields.

**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 with chest pain where aspirin was indicated based upon the clinical encounter, there was no record of ASA administration whatsoever.

Thus, the performance improvement activities here should focus on two areas: 1) Education regarding the importance of aspirin administration whenever there are indications of potential acute coronary syndrome/non-traumatic chest pain; 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 patient encounters where an overdose was suspected compared to the total volume of patient encounters. Chart 6 shows that of the 7.58 million encounters in our sample, 125,768 had a primary impression related to overdose (or 1.65%). Men accounted for 58.2% of overdose encounters; women accounted for 41.8%.

Interestingly, overdoses account for nearly 40% more encounters than stroke as a primary impression. This is a significant jump from 2017 (12%) and shows that overdoses continue to represent a major public health concern.

Overdoses continue to be a national problem, with more than 70,000 deaths in 2017, according to the CDC.

Fentanyl is one of the most dangerous drugs, with more than 28,000 associated deaths in 2017 - representing nearly 40% of all overdose deaths.
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 patients who have experienced an overdose to seek rehabilitation.

While overdoses in general remain a steady concern, we may be seeing some positive signs regarding opioids — specifically, prescription opioids. Based on our data, we see that nearly 94% of opioid overdoses involved illicit drugs, while only 4% involved prescription opioids (2% did not include documentation of substance type). According to our data, EMS responses for opioid overdoses peaked in July 2018 but have fallen steadily since and continue to trend downward.

What we are seeing is that opioid overdoses are very different from other types of overdoses and this might be some of the first good news regarding this epidemic.

The focus on appropriate prescribing practices appears to have reduced the incidence of prescription-based opioid overdose when compared to other types of overdose. While we suspect some of the downward trend in opioid overdose incidents may be due to self or buddy treatment with the widely distributed intranasal naloxone kits, the trend toward a decrease in opioid overdose events is encouraging and, if it continues, may signal that the entirety of the national efforts towards opioid overdose reduction is beginning to produce the desired outcome.
INDEX METRICS

INFLUENZA-LIKE ILLNESS IMPRESSIONS

The flu metric looks at the number of patients identified with a primary impression of influenza-like illness based on seasonality. Not surprisingly, we see the biggest jump in flu encounters in the winter months (late December to late February).

Chart 7 shows there were 78,646 flu encounters, accounting for approximately 1% of all calls over the course of the year. July 22–28 represented the lowest weekly volume of flu calls (with 1,093), while January 21–27 represented the most (3,045).

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

2018 was a particularly severe year – the first season to be classified as having a high level of severity across all age groups –
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.
CONCLUSION

SO, WHAT DOES THIS MEAN?

Overall, we are seeing a year-over-year improvement in performance and documentation around the key metrics included in this Index. However, there are signals for some areas that warrant further attention and demonstrate opportunity for improvements around stroke assessment, 12-lead EKG, and aspirin administration.

STROKE ASSESSMENT (OR DOCUMENTATION OF STROKE ASSESSMENT) JUMPED FROM

<table>
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<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
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<td>50.0%</td>
</tr>
<tr>
<td>2018</td>
<td>65.0%</td>
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</tbody>
</table>

This is a great improvement; however, more needs to be done to ensure that patients suspected to be experiencing a stroke are receiving a full assessment and that this assessment is being appropriately documented.

12-LEAD EKG IS BEING PERFORMED

77.4% OF THE TIME

(a slight improvement from 75.9% in 2017) in events where the primary impression is non-traumatic chest pain among adult patients. Considering how stroke assessment has evolved and studies show how 12-lead EKG can save precious minutes in door-to-balloon time, performing and documenting a 12-lead EKG should be standard practice.

ASPIRIN HAS THE POTENTIAL TO PLAY A CRUCIAL ROLE

In reducing deaths associated with acute coronary syndrome, so a

52.3% ASPIRIN ADMINISTRATION AND/OR DOCUMENTATION RATE

is far too low and needs improvement.
METHODOLOGY

The dataset for the 2019 ESO EMS Index is real-world, de-identified data, compiled and aggregated from more than 1,200 agencies across the United States that use ESO’s products and services. These data are based on 7.58 million anonymized patient encounters between January 1, 2018 and December 31, 2018, 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 seek to identify which metrics and drivers can have the biggest local effect on the organization and patients served. With this as a foundation, organizations can do their own analysis to serve as the basis for other modeling and outcomes.

The metrics shown in this study 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 the what we are seeing nationally.

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

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ABOUT ESO

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 more than 14,000 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.