

Telehealth dashboard: leverage reporting functionality to increase awareness of high-acuity emergency department patients across an enterprise practice

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ABSTRACT

Background Emergency Medicine Telehealth (TeleEM) represents an opportunity to work directly with referral centres, rural facilities and underserved areas to mitigate unnecessary testing, optimise resource utilisation and facilitate patient transfers across health systems. To optimise the impact of a TeleEM programme, a tool is needed to remotely monitor patient activity in multiple emergency department facilities, concurrently.

Methods After identifying data sources for activation criteria put forth by the TeleEM operations group, rules were constructed within the electronic health record to facilitate data checks and ultimately produce a yes/no response if the category's conditions were met. Responses were organised into a table, with functionality allowing end users to drill into the different sites to see patient-specific information for patients meeting activation criteria.

Conclusions The TeleEM dashboard allows for proactive engagement by the TeleEM physician and strengthens the team-based approach of critically ill.

BACKGROUND

The USA has seen a dramatic expansion in telehealth programme driven by the critical need to provide high-quality care while reducing healthcare costs.^{1–24} To date, most acute care telehealth activity has focused on Telestroke^{1 2}; however, Emergency Medicine (EM) is a specialty uniquely positioned to directly impact patient movement and system utilisation. Approximately 40% of clinicians practising EM are not board-certified. The proportion of a board-certified to non-board-certified EM clinicians favours urban settings when compared with rural areas.²⁵ Emergency Medicine Telehealth (TeleEM) represents an opportunity to work directly with referral centres, rural facilities and underserved areas to optimise resource utilisation and facilitate patient transfers across health systems.

To fill this need, our institution developed a TeleEM programme serving 18 regional hospitals. Initially, criteria were created and distributed encouraging providers in these facilities to contact the TeleEM physician when they were in need of video or phone consultation. The engagement was limited as often the time when they needed the most help coincided with an interval when making a phone call was impractical. An opportunity was discovered: the TeleEM providers needed a mechanism to be able to identify which sites were caring for patients who were critically ill or providers who may be in need of assistance due to high census or mass casualty across a large, primarily rural, geographically dispersed healthcare system.

OBJECTIVE

The TeleEM Dashboard was created to provide TeleEM physicians with a means to remotely monitor patient activity in multiple emergency department (ED) facilities, concurrently, within a single frame of view. We describe the development of a novel dashboard to create system-wide situational awareness and provide opportunities for earlier intervention by a TeleEM team.

METHODS

The display is driven by a single query, identifying active ED visits by selecting encounters with an ED arrival date/time and a null ED departure date/time within the electronic health record (EHR) application database. The query is re-submitted approximately every 5 min using a batch scheduling process as the principal data refresh mechanism.



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Table 1 TeleEM activation criteria mapping to alert categories

Activation criteria	ALERT category	Data source
Critical care	ESI 1	ESI level
Critical care	ESI 2	ESI level
Level yellow or red trauma resuscitations	Trauma	Documentation tool usage
Cardiac arrests or haemodynamic instability/shock	Code	Documentation tool usage
Intracranial haemorrhage	Stroke	Documentation tool usage
Chest pain—including STEMI and NSTEMI	STEMI	Documentation tool usage
Need for sedation—agitation or procedural	Sedation	Documentation tool usage
Sepsis or suspected sepsis	Sepsis	Clinical decision support
Suspected shock	Shock	Clinical decision support
Neutropenic fever or fever in immunocompromised host	Neutropenia	Clinical decision support
Unresponsive mental status	Unresponsive	Chief complaint
Haemophilia with possible acute bleeds	Haemophilia	Medical history, active care plans
Moderate or severe croup	Croup	Chief complaint
Significant burns, neonatal fever, suspected child abuse	Other CC	Chief complaint, vitals
Various	Antibiotics	Medication ordering behaviour
Symptomatic atrial fibrillation	Antiarrhythmic/antihypertensive	Medication ordering behaviour
Haemorrhage with current anticoagulation status	Anticoagulant	Medication ordering behaviour
Adverse drug events, anaphylaxis, bronchiolitis	Epinephrine/allergic reaction treatment	Medication ordering behaviour
Diabetic ketoacidosis	Insulin	Medication ordering behaviour
Respiratory failure or distress	Respiratory treatment	Medication ordering behaviour, ventilator usage
Toxic ingestions, overdose or exposure	Reversal agents/overdose treatment	Medication ordering behaviour

CC, chief complaint; ESI, Emergency Severity Index; NSTEMI, non-ST-elevation myocardial infarction; STEMI, ST-elevation myocardial infarction.

Technical

At the time of this publication, our commercial EHR did not provide a means to assess alert categories for multiple patient records, concurrently, *in real time*. Functionality existed, pursuant to a user trigger, for real-time evaluation of all criteria within an individual patient record; conversely, in order to facilitate a multiple record evaluation, we were limited to using a queue, recurring system process or a scheduled batch process. The smallest

interval we could reasonably allow a job or process to recur was 5 min in order to avoid negative performance issues. This concern precluded providing users with a means to perform an ad-hoc display refresh.

Human

We acknowledge that an alert system partially premised on metadata acquired through system use itself is susceptible to error, both false positives and complete misses. When

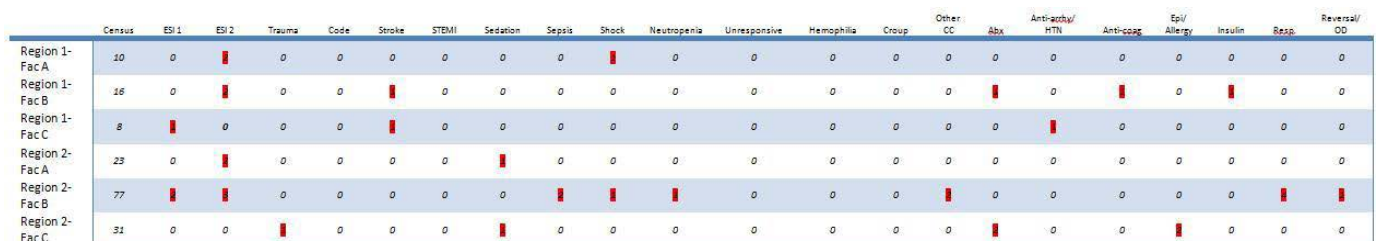


Figure 2 TeleEM Dashboard alert category display by facility.



implementing our EHR, best practice system workflow was determined and provided the basis for the training curriculum as well as this tool's design. However, as the system continues to evolve, new users join the user base and existing users seek more efficient ways to document in the EHR, it is unrealistic to assume that prescribed system use workflows are followed in every case.

Contextual

The contextual limitations stemmed from a lack of discrete data availability. At the time of this publication, our organisation captured most provider documentation in a note feature that stored a mixture of structured and unstructured data points. Certain elements such as the patient's history of present illness, physical examination findings and a review of systems were generally available as discrete data points within a provider note; however, other key data like medical decision making and course/workup comments were not harvestable without the use of an integrated natural language processing application. As a result, we had to consider alternative data points from the available pool to drive our category alert mechanisms which, at times, made them overly broad. We see the addition of a natural language processing platform as the next logical path to refine our alert sensitivity by targeting decision-making input directly, as opposed to relying on secondary sources.

Finally, a lack of precise data contributed to the difficulty in crafting alerts for a subset of activation criteria due to the risk of over-alerting. This is particularly problematic for criteria that may align with a high volume of visits, yet, have additional parameters applying only to a subset, or are generally areas where TeleEM providers are only consulted by request. For example, remote providers may offer assistance to local clinicians treating patients for severe headaches or migraines, yet to produce an alert for every patient presenting with an arrival complaint of headache or migraine may lead to alert fatigue or desensitisation. Comparable challenges existed for other activation criteria such as difficult epistaxis, abdominal pain of unclear aetiology and active seizures. Again, we see opportunities with natural language processing tools to advance alerting capabilities in these areas.

DISCUSSION

Despite the technical, human and contextual challenges faced by the build team, utilisation of the EM TeleEM Dashboard has created an opportunity to enhance value for each patient encounter. Traditional TeleEM provides a video or phone consultation only when activated by the receiving provider. The development of the EM TeleEM Dashboard allows for *proactive* engagement by the TeleEM physician. In our practice, the dashboard has allowed for quick identification of critically ill patients across our sites and increased the use of the collaborative approach telemedicine provides.

Although TeleEM physicians cannot demand utilisation, they can encourage its use especially for resource-limited and geographically dispersed EDs. Ten of our EDs hold a federal critical access (CA) designation. Those low-volume, rural EDs are often staffed with a nurse practitioner (NP), physician assistant (PA) and one or two nurses (RN). Critically ill patients demand a team-based approach, and the addition of the TeleEM physician, via video, can offload the cognitive burden of the rural provider by providing clinical guidance and arranging ambulance or helicopter transport, allowing them to focus on the patient at the bedside. Furthermore, the dashboard allows the teleEM physician the opportunity to identify situations where initiating telemedicine could benefit the patient and the healthcare team, removing the onus of making initial contact in stressful situations for already stretched care teams.

CONCLUSIONS

TeleEM has significant potential to increase the quality of care and decrease resource utilisation in EDs across the country. Engagement with the service can be significantly enhanced through the development of a TeleEM Dashboard promoting the proactive engagement of the TeleEM physician.

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