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Columbia VA Health Care System
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Improving Emergency Department Patient Flow Through Automated Visual Management Systems

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Background

Reducing the time patients remain in the emergency department (ED) improves access to treatment and increases quality of care. This reduction is dependent on achieving improvements in overall ED flow among staff, communication with patients, and the understanding of real-time performance and future needs. The Center for Disease Control and Prevention highlighted these challenges that all health care system EDs experience, as wait times in the United States have risen by over 25% since 2003. The Columbia VA Health Care System experienced these same challenges, however through a structured Continuous Process Improvement approach has recognized, assessed, developed and implemented sustainable Visual Management Systems which have reshaped how we do business. Bottlenecks and barriers to patient flow in the ED are now addressed thoughtfully and timely, which has led to enhanced performance and outcomes. Visual Management Systems are now accepted as essential for achieving smooth throughput, reducing wait times, decreasing treatment delays, and improving overall patient satisfaction. Recognizing that length of stay in the ED is a challenge nationwide, Columbia VA Health Care System has developed an automated system for visualizing both current and projected patient flow to provide high level process overviews with on-demand drill down capability.

Objectives

- Leverage existing software resources capable of conducting vectorized operations to extract, clean, and analyze large amounts of data on a daily basis.
- Generate valuable insights into complex processes for clinical and executive leadership while eliminating analytic and administrative burden.
- Create a “one-stop-shop” to house all ED data monitoring, reporting, and improvement tools.
- Employ machine learning algorithms to provide reliable predictions of patient arrivals and flow trends to enable optimization of staffing and resource management.

Planning

In order to develop the user requirements for accurately assessing current performance in a variety of national ED metrics including length of stay, patient flow, and service quality, an interdisciplinary team comprised of subject matter experts from several hospital services reviewed 4 years of data comprised of 169,330 visits to the Columbia VA Health Care System Emergency Department. An in-house development team with expertise in operational data science analyzed the dataset to uncover key metric drivers and patient arrival trends using a combination of Bootstrap Aggregation, Random Forests, and K-means Clustering. This was then used to create a highly reliable rule-based classification algorithm.

Implementation

The development team worked with key stakeholders to build the Emergency Department Patient Flow Tool, an automated visual management system built with existing resources using a Tableau software platform at no additional cost. The tool displays real-time data to show current flow bottlenecks, historic trends, and future predictions of key performance indicators. It allows users to easily interact with high level overviews, identify challenges, and drill down to root causes in one cohesive package. To eliminate the need for specialized technical staff, the developers embedded custom queries in the tool to automatically extract a series of datasets from our national data warehouse, developed a robust framework of dynamic code libraries with minimal technical debt, and used existing resources to streamline front-end development and support. This resulted in a tool comprised of self-evident operations requiring little to no user training or technical knowledge.

Results

The Emergency Department Patient Flow Tool has enabled staff from front-line supervisors to executive leadership to gain crucial insights into key areas of ED patient flow in order to conduct real-time, data informed management. Since its release, the Columbia VA Health Care System has seen significant improvements in the majority of ED metrics including a 9.8% decrease in Joint Commission measure ED-1: Median Time from ED Arrival to Departure for Admitted Patients and a 36.8% reduction in patients Leaving Without Being Seen/Treated (LWOBS). Additionally, the tool has been adopted by several VA health care systems nationwide, has received the 2018 South Carolina Hospital Association Lewis Blackman Award for Innovation & Research, and was the first-place winner of the 2018 VHA Southeast Network Idea House Competition. Bottlenecks in ED flow and overall access can now be addressed successfully in any organization with use of this approach, which will ultimately allow any facility to move closer towards the goals of being a High Reliability Organization.

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