645 ARE IMPROVEMENT OUTCOMES SUSTAINABLE WITHIN A DYNAMIC CLINICAL ENVIRONMENT?

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Background Systematic literature reviews show a paucity of publications describing the sustainability of quality improvement (QI) outcomes beyond one year. Hence, sustainability is not well understood, particularly in relation to ongoing improvement work and process changes in clinical care environment.

Objectives To evaluate the sustainability of an improved outcome resulting from a QI intervention to provide timely intravenous opioid delivery to patients with long bone fractures in a pediatric emergency department (PED) despite a dynamic QI environment. The initial QI intervention was implemented October 2007.

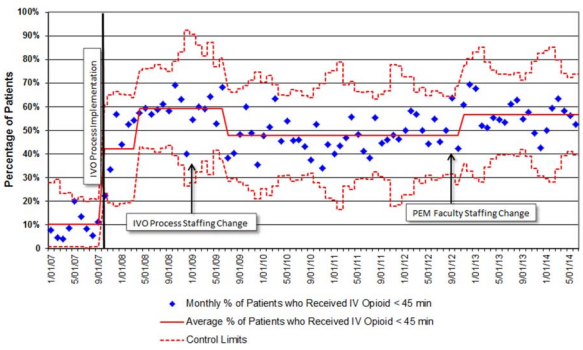

Figure 1 Patients with Acute Long Bone Fractures Who Received a dose of iv Opioid within 45 minutes of Arrival January 2007 thru june 2014.

Table 1. Process changes within the pediatric emergency department between January 2007 and June 2014.

Process Change	*Implementation date*	*Description*
Initial Intervention for Timely IV Opioid Delivery (IVO Process)	*October 2007*	*The original improvement process to expedite delivery of intravenous opioid pain medications to patients with clinically-apparent long bone fractures*
Change in IVO Process Physician Staffing	January 2009	The IVO Process was originally staffed by a general pediatric physician, and later changed to a resident physician with pediatric emergency medicine faculty physician supervision.
ED Fast Track Implementation	May 2011	Fast Track was a minor care section of the ED with clinical space and staff dedicated to expedite the care of lower acuity injuries and illnesses
PEM Faculty Staffing Changes	September 2012	Increased hours of pediatric emergency medicine (PEM) faculty physician staffing to expedite the flow of patient care
Rapid Response Pager for Select Patient Care Groups	February 2013	QI intervention to expedite goal-oriented care for status asthmaticus, migraine headache, sickle cell vaso-occlusive pain, testicular pain and gastrostomy tube replacement.
Change in IVO Process Location	May 2013	The IVO Process was originally located in the shock-trauma suite, and later relocated to triage suite.
Rapid Assessment of Patients with Suspected Sepsis	June 2013	QI intervention to expedite goal-oriented care for potentially septic, high-risk patients.
On-Site Urgent Care Facility Opening	July 2013	The Urgent Care largely replaced the function of Fast Track for the care of minor illnesses and injuries during peak patient volume hours.

Methods The primary outcome was the proportion of patients with long-bone fractures receiving intravenous opioids within 45 minutes of arrival to an urban tertiary PED setting. Retrospective visit level data from 1/2007 through 6/2014 were

Table 2 Interrupted Time Series Analysis Results Dependent Variable: % of patients with long bone fracture who received an IV opioid within 45 minutes

Time Series Variable	Regression Coefficient	95% Confidence Interval
Time*	0.5	−1.5, 2.5
IVO Process†	28.1	15.3, 40.9
Time after IVO Process Implementation‡	1.1	−1.1, 3.4
IVO Physician Staffing Change†	−11.8	−20.9, −2.8
Time after IVO Process Physician Staffing Change‡	−1.8	−2.7, −0.8
PEM Faculty Staffing Change†	12.2	3.9, 20.5
Time after PEM Faculty Staffing Change‡	−0.1	−0.6, 0.5

*Month numbered sequentially.
†Indicator variable denoting when the intervention was implemented.
‡Month denoted as 0 pre-intervention and numbered sequentially post-intervention.

obtained from the electronic health record. table 1 summarizes PED process changes implemented after the initial QI intervention. The effects of process changes on the primary outcome were determined using a monthly control chart (p-chart) and an interrupted autoregressive time series model.

Results Overall, improvement in the proportion of patients receiving timely intravenous opioids has been sustained for seven years since the initial implementation (figure 1). The p-chart, which is further supported by the results from the interrupted time series analysis (table 2), shows special cause variation attributable to two additional process changes related to physician responsibilities and staffing.

Conclusions Our initial improvement gains were robust despite multiple process changes in the care environment. Changes in physician staffing and physician responsibilities in a PED may be especially important to consider for future improvement initiatives.