BRIEF OBSERVATION

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Quality Improvement Process in a Sickle Cell Infusion Center

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ABSTRACT

BACKGROUND: The American Pain Society recommends that individuals experiencing sickle cell crisis receive parenteral pain medication within 30 minutes of assessment. We examined factors affecting achievement of this standard at the Johns Hopkins Sickle Cell Infusion Center.

METHODS: Baseline patient care time intervals and data on variables affecting the ability to achieve the American Pain Society goal were measured. Time to first parenteral opiate administration was modeled using simple and multivariable linear regression.

RESULTS: Mean time from initial assessment to first dose was initially 41 minutes. Increased nurse to patient ratio decreased time to first dose.

CONCLUSIONS: Of the factors associated with improved times to first dose, only nurse to patient ratio is amenable to process change, suggesting it as a potential target for future interventions.

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KEYWORDS: Acute care; Quality improvement; Sickle cell disease

Sickle cell disease is a life-threatening inherited red blood cell disorder affecting approximately 100,000 individuals in the United States.[1] Episodes of acute "pain crises" are the most common clinical manifestation and are linked to increased mortality.[2] Care for pain crises is typically sought in emergency departments and is often inadequate.[3] The American Pain Society guidelines regarding pain management for sickle cell disease recommend that parenteral analgesics for acute pain crises should begin within 30 minutes of arrival.[4,5] This recommendation is habitually unmet,[3] with the median time to first dose of analgesic ranging from 77 to 107 minutes.[3] From January to June 2012, the mean time to first dose at the Johns Hopkins Adult Emergency Department was 166 minutes.[6] Infusion centers can model how to manage patients with sickle cell disease who are experiencing acute pain crises by demonstrating a reduction in time to pain relief and hospital admissions.[7]

The Johns Hopkins Hospital Sickle Cell Infusion Center opened in 2008. The Sickle Cell Infusion Center is open 7 days a week for 8 hours and provides individualized care for persons with sickle cell disease experiencing a pain crisis. Staffing at the Sickle Cell Infusion Center includes 1 to 2 registered nurses, a physician assistant, a medical office coordinator, a clinical technician, and a social worker. It contains 4 infusion beds and 1 examination room, and averages 4.1 patients daily. All staff have extensive training in acute and chronic sickle cell disease management.

When the Sickle Cell Infusion Center is open, patients arrive from home or as an emergency department transfer. Patients arriving from home first call the clinic to assess whether their symptoms can be accommodated in the Sickle Cell Infusion Center. If patients presented to the emergency department while the Infusion Center was closed and require continued outpatient treatment when the Sickle Cell Infusion Center opens, they may be transferred.

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Historical data from the Sickle Cell Infusion Center suggest that this model achieves outcomes closer to the American Pain Society's guidelines than most emergency departments.[3,6] By using a slightly different outcome measure than the American Pain Society, we measured time from triage to first parenteral opioid instead of time from registration to first parenteral opioid. The National Initiative for Children's Healthcare Quality recommended this modified outcome measure.

Quality improvement relies on continuous and methodical approaches to measurable improvement in the health of individuals or health care services.[8] Quality improvement efforts can focus on care processes and patient-centered outcomes. The objectives of our quality improvement effort were to (1) provide a comprehensive description of a variety of process variables for the Sickle Cell Infusion Center and (2) examine determinants of the process variable, time to first dose. Ultimately, we wanted to determine target areas for process improvement to achieve the American Pain Society's guidelines.

CLINICAL SIGNIFICANCE

- A refined process for acute care management will ensure that all patients receive safe, effective, efficient, and equitable care.
- Alternative routes of administration for parenteral analgesic or technology improving time to intravenous access are a possible solution to improve time to first parenteral analgesic.
- Improving the timeliness of pain control is a patient-centered approach to improve outcomes.

MATERIALS AND METHODS

Infusion Center Operating Procedure

On arrival to the Sickle Cell Infusion Center, the medical office coordinator registers the patient. The clinical technician assesses the patient's vital signs and begins peripheral intravenous line placement. The clinical technician attempts to place a peripheral intravenous line up to 3 times. If unsuccessful, a nurse places the line. Only a nurse can access implantable central venous access devices. The patient is assessed by the nurse and provider; the provider then places orders. After medication administration, a nurse conducts pain reassessment and discusses with the provider the next steps in treatment. The process map (**Figure**) outlines the steps involved in pain management and mean times for each step.

Process of Care Outcomes and Predictors of Interest

In February 2013, the Sickle Cell Infusion Center staff designed a data collection sheet to measure timing of care (**Figure**). Outcome variables included time of arrival; registration time; initial assessment by clinical technician, nurse, and prescribing provider; provider orders; first dose of opiate analgesic administration; and pain reassessment. Potential predictor variables were order of patient arrival, type of access (peripheral or central access, or access obtained in emergency department), daily patient census, and nurse to patient ratio.

The daily patient census was retrieved from the Johns Hopkins electronic medical record. The number of nurses was based on nurse schedules.

Data Analysis

Analyses were conducted using Stata version 12 (StataCorp LP, College Station, Tex). We modeled time to first parenteral opiate using simple and multivariable linear regression with adjustment for clustering of observations within patients. For our bivariate analyses, we conducted simple linear regression on all variables examining unadjusted association of potential predictors and time to first dose. Any variable with a statistically significant result ($P \leq .05$) was subsequently included in a multivariable linear regression model.

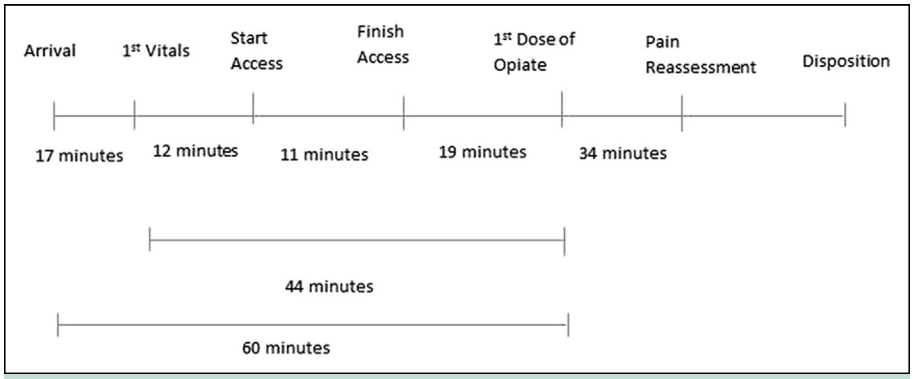

Figure Mean times process map.