A Quality Improvement Initiative to Reduce Safety Events Among Adolescents Hospitalized After a Suicide Attempt

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ABSTRACT

BACKGROUND AND OBJECTIVES: Self-harm among adolescents is a common problem, resulting in large numbers of patients admitted for medical stabilization after a suicide attempt. Because of limited mental health resources, these high-risk patients remain in inpatient settings once medically stabilized until psychiatric placement can be arranged. During this time, patients are at risk for safety events, including self-harm and elopement. Using quality improvement (QI) methodology, we aimed to reduce the frequency of significant safety events (SSEs) in this population by targeting modifiable risk factors and standardizing care.

METHODS: This was a QI study conducted at a medium-sized academic center. Key interventions included the development of the Pediatric Behavioral Health Safety Protocol, standardization of the patient safety search, and implementation of a daily Safety Huddle. Process measures were selected as metrics of use and adherence to the newly developed protocol. The rate of SSEs per 100 patient days was the primary outcome measure.

RESULTS: There were 224 patients included in our study: 53 in the preimplementation and 171 in the postimplementation groups. Use of the Pediatric Behavioral Health Safety Protocol increased to 91.8% after implementation. The rate of SSEs per 100 patient days decreased from an average of 2.7 events per 100 patient days in the preimplementation period to 0.17 events per 100 patient days in the postimplementation period.

CONCLUSIONS: The use of QI methodology to improve safety for adolescents admitted after a suicide attempt led to a substantial and sustainable reduction in the rate of SSEs at our institution.
Rates of adolescent mental health disorders have reached epidemic proportions in the United States, with ∼20% of adolescents meeting diagnostic criteria for a mental health disorder. Depression, suicide, and suicidal ideation represent a significant proportion of these diagnoses and predispose adolescents to self-harm. Although much of the management of these patients occurs in the outpatient setting, roles for the emergency department (ED) and inpatient environments are increasing. In a recent study, nearly 10% of pediatric admissions nationwide had a primary mental illness as the principal diagnosis, with depression being the most common. Researchers suggest that 33% to 50% of pediatric patients who require inpatient psychiatric treatment who present to the ED for care are boarded in the ED or on general inpatient units while awaiting psychiatric placement. Additionally, the majority of suicides and acts of violence among hospitalized patients occur during the first week of hospitalization, a time frame relevant to the boarding population. Within designated adult psychiatric inpatient facilities, safety protocols and guidelines have been described in the literature. For pediatric medical units, however, studies pertaining to psychiatric patient safety are lacking. Therefore, instituting protocols to keep this growing population safe and developing measures to determine success are imperative.

After experiencing a cluster of significant safety events (SSEs) (defined as elopement, harm to self, or harm of others) among psychiatric boarders on the pediatric medical floors at our institution, a multidisciplinary, interprofessional team formed to address this problem. The global aim of this work group was to improve the safety of care provided to adolescents admitted after a suicide attempt. The specific aim in this quality improvement (QI) project was to reduce the frequency of SSEs per 100 patient days in the target population by 50% within 1 year of protocol implementation.

METHODS
Context
From January 2017 to June 2018 we conducted a QI project at our 150-bed tertiary-care pediatric academic medical center located within the Pacific Northwest. We applied our interventions to all patients admitted for medical stabilization after a suicide attempt but analyzed only those who were admitted to 2 specific study units: the PICU and the pediatric acute-care medical unit (PACM). Patients admitted or transferred to the PACM were placed on a general hospitalist service with pediatric psychiatry serving as consultants. We excluded patients who were admitted to the surgical care unit or had pediatric psychiatry team involvement for reasons other than suicide attempt. During the preintervention period, there was no standardized approach to the care of adolescents admitted after a suicide attempt. These patients were admitted to the PACM or PICU, and a full-time patient safety attendant (PSA) or sitter, with the level of training of a certified nursing assistant, was placed within the patient’s room. There were no formal agreements on many important aspects of care (eg, walk off the medical unit, visitors, access to personal cell phones, or other belongings). Questions regarding these issues were left to the discretion of attending hospitalists or psychiatry consultants, sometimes with conflicting opinions.

Interventions
In 2016 we experienced a cluster of SSEs defined as elopement, harm to self, or harm to others, with 2 occurring within 1 calendar month. On the basis of root cause analysis (RCA) of these events, we noted a lack of consistency in both the approach to care of this patient population and the communication between team members. We formed a multidisciplinary team that included pediatric hospitalists, pediatric psychiatrists, nursing leadership, floor nurses, and social workers to develop interventions aimed at improving the safety of care provided for adolescents admitted after a suicide attempt. On the basis of results from the RCAs, we identified modifiable risk factors common to all reviewed SSEs and used these to develop 3 key drivers to promote patient safety: standardized approach to care, consistent performance of a safety search, and development of a shared mental model among care team members (Fig 1). Over the following year, using plan-do-study-act methodology, we developed and implemented 3 improvement interventions: the Pediatric Behavioral Health Safety Protocol (PBHSP) with electronic medical record (EMR) order set, a standardized safety search with EMR documentation, and a standardized communication process, or Safety Huddle, between care team members.

Standardized Approach to Care
The improvement team created the PBHSP treatment protocol for the care of patients admitted after a suicide attempt (see Supplemental Fig 4). Given the lack of literature to guide the care of this population in the medical inpatient setting, our protocol was based on SSE RCAs, expert opinion, and care team members’ experience.

First, we discovered that virtually none of the patients admitted to the inpatient setting had a behavioral hold order placed or consent for mental health treatment signed and scanned into the medical record. Should a patient elope, this behavioral hold order is necessary for public safety personnel (state-certified police officers employed by the institution to provide campus security) to physically return the patient to the unit. We added this behavioral hold order to the protocol and order set as well as the requirement for having a guardian sign a consent for mental health treatment and scanning this consent into the chart. We standardized the process of documenting a patient’s description in the medical chart and reporting the description to public safety on admission. The handoff tool used by our PSAs and nurses was updated (see Supplemental Fig 5), reinforcing a shared mental model and understanding of individual patient risk factors. Additional nursing responsibilities included performing a full safety search of patient belongings on arrival to the units, documentation of patient belongings, and removal of items that could pose harm to the patient. We also clearly delineated what patients would be allowed to do during their admission: expectation of attending school,
not allowing walks off the medical unit or to unsecured courtyards, limiting visitors, and not allowing patients to wear their own shoes and/or clothing or to have access to personal cell phones and tablets because of concerns regarding social media use. We created an EMR order set that included the order for the behavioral health protocol as well as all the elements included therein and links to consent forms and institutional safety search policies.

**Consistency and Accuracy of the Safety Search**

Through our RCA reviews it came to light that patients and their belongings were not routinely being searched for items that could cause harm. In addition to including the performance of a safety search in the PBHSP, we defined the standard work for performing the search as well as documentation in the EMR. In accordance with our institutional policy, a safety search of all patient belongings and the patients themselves was to be conducted by 2 nurses within 2 hours of arrival to the medical inpatient unit. Information on patient belongings, including objects found and whether items were stored in locked cabinets in patient rooms or sent home with family members, was documented in the EMR. Throughout the rollout phase of the protocol, weekly real-time chart audits and nurse interviews as well as monthly run chart reviews were conducted. We learned from nurse interviews that accessing the correct flowsheet rows was a barrier to completion of documentation. After learning this, EMR improvement requests were made to streamline the safety search documentation process.

**Development of a Shared Mental Model**

It became clear during our case review process that team communication was not optimal. Lack of a shared mental model regarding severity of illness, potential for behavioral escalation, and contingency planning should a patient escalate contributed to inconsistencies and delays in behavioral interventions. To address this issue, we implemented the Safety Huddle: a standardized communication huddle involving the medical and psychiatric care teams as well as social work, nursing, and public safety. In the initial iteration of the PBHSP, Safety Huddles were to occur on an as-needed basis when behavioral or safety concerns arose. During our weekly process audits, nurse and/or provider interviews, and run chart review, we found that the Safety Huddles were not occurring at the appropriate time. On the basis of this learning, in June of 2017, we adjusted the expectation of when Safety Huddles should occur: for all patients within 24 hours of arrival to the PACM and for those with ongoing behavioral concerns. In addition to adding a standardized Safety Huddle for all patients on admission, a standard script and dot phrase was created to guide discussion on behavioral triggers, de-escalation strategies, and plans for
intervention in case of behavioral escalation (see Supplemental Fig 6).

**Study of the Intervention**

Demographic data are presented with counts and/or percentages and grouped by pre- and postimplementation groups in reference to the PBHSP go-live date of January 27, 2017 (Table 1). A \( \chi^2 \) test or independent sample t test was used to assess differences in group characteristics. SPSS version 25 (IBM SPSS Statistics, IBM Corporation, Armonk, NY) was used for analysis.

Baseline rate of SSEs per 100 patient days was collected via retrospective chart review from June 2016 to December 2016. An SSE was determined to have occurred if documentation in the medical chart reflected either patient elopement from the medical unit, inflicting self-harm, or harm of others. Monthly chart reviews were conducted during the postimplementation period (January 2017 to June 2018) for tracking process and outcome measures.

**Measures and Analysis**

The main outcome measure was the rate of SSEs per 100 patient days in the target population. Process measures were selected as metrics of use and adherence to the PBHSP. Process measures included percent of patients with the order for the PBHSP placed on admission, percent of patients with a signed consent for mental health treatment scanned into the medical chart, and percent of patients with a safety search documented within 2 hours of admission. Balancing measures included transfer from the PACM to PICU because of a need for higher level of care for behavioral interventions and whether episodes of behavioral escalation were triggered by protocol restrictions. We compared measures after the implementation of the PBHSP (January 27, 2017 to June 30, 2018) with the same measurements during the baseline period (June 1, 2016 to January 26, 2017). To ensure completeness of data, patients were identified through review of a comprehensive database maintained by the pediatric psychiatry service and screened for inclusion criteria. The number of patients per month ranged from 2 to 16, with a median of 9. There were no additional hospital-wide interventions targeting patients admitted after a suicide attempt or behavioral escalation during the study period.

Chart review data were used to calculate process and outcome measures. Process measures were plotted over time in run charts.20 The outcome measure (rate of SSEs per 100 patient days) was monitored with a statistical process control (SPC) u-chart. Run and SPC charts were developed with Microsoft Excel QI macros.

**Ethical Considerations**

The Oregon Health and Science University Institutional Review Board approved this study. No interventions involved comparison of therapies, and subjects were not randomly assigned. All charts were accessible by a subset of improvement team members, and no personal health information was shared outside of the organization.

**RESULTS**

A total of 224 patients were reviewed: 53 from the preimplementation period and 171 postprotocol implementation. All patients included in the study were admitted for suicide attempt. The characteristics of patients during the different time periods are presented in Table 1. Both groups were similar for all variables, with the exception of race \( (P = .03) \).

After protocol implementation, 91.9% of patients had the order for the PBHSP placed on admission. A shift (8 consecutive points greater than the mean) first occurred in February of 2017 (Fig 2A). The percentage of patients with a signed, scanned consent for

**TABLE 1 Study Population \( (N = 224) \)**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Preimplementation ( (n = 53) )</th>
<th>Postimplementation ( (n = 171) )</th>
<th>( P^a )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age y, average (SD)</td>
<td>15.1 (1.7)</td>
<td>15.0 (1.5)</td>
<td>.72</td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td></td>
<td></td>
<td>.49</td>
</tr>
<tr>
<td>Female</td>
<td>43 (81)</td>
<td>131 (77)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10 (19)</td>
<td>40 (23)</td>
<td></td>
</tr>
<tr>
<td>Admission unit, n (%)</td>
<td></td>
<td></td>
<td>.73</td>
</tr>
<tr>
<td>PICU</td>
<td>24 (45)</td>
<td>82 (48)</td>
<td></td>
</tr>
<tr>
<td>Medical unit</td>
<td>29 (55)</td>
<td>89 (52)</td>
<td></td>
</tr>
<tr>
<td>Race and/or ethnicity, n (%)</td>
<td></td>
<td></td>
<td>.03</td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>33 (62)</td>
<td>120 (70)</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic African American</td>
<td>1 (2)</td>
<td>5 (3)</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>6 (11)</td>
<td>30 (18)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>13 (25)</td>
<td>16 (9)</td>
<td></td>
</tr>
<tr>
<td>Payer, n (%)</td>
<td></td>
<td></td>
<td>.67</td>
</tr>
<tr>
<td>Government</td>
<td>27 (51)</td>
<td>77 (45)</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>25 (47)</td>
<td>92 (54)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1 (2)</td>
<td>2 (1)</td>
<td></td>
</tr>
<tr>
<td>LOS, d, mean (SD)</td>
<td>3.1 (2.7)</td>
<td>3.3 (2.6)</td>
<td>.62</td>
</tr>
<tr>
<td>Disposition, n (%)</td>
<td></td>
<td></td>
<td>.83</td>
</tr>
<tr>
<td>Home</td>
<td>33 (62)</td>
<td>114 (67)</td>
<td></td>
</tr>
<tr>
<td>Psychiatric hospital</td>
<td>18 (34)</td>
<td>52 (30)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2 (4)</td>
<td>5 (3)</td>
<td></td>
</tr>
</tbody>
</table>

LOS, length of stay.

\( ^a \) t tests and \( \chi^2 \) tests were used for continuous and categorical variables.
FIGURE 2  Run charts reflecting process measures. A, Percent of patients with PBHSP ordered at time of admission. B, Percent of patients with completed consent for mental health treatment scanned into the chart. C, Percent of patients with completed safety search documentation.
mental health treatment in the EMR increased from 4.7% to 84.9% after go live of the protocol, and a shift first occurred in January of 2017 (Fig 2B). The rate of safety search documentation did not change significantly after the implementation of our improvement interventions (Fig 2C). Our second improvement intervention focusing on EMR improvement for nursing safety search documentation was not fully implemented because of institutional availability of informaticist time.

After implementation of the PBHSP, the frequency of SSEs per 100 patient days decreased significantly from an average of 2.7 to 0.17 events per 100 patient days, with narrowing of the control limits (Fig 3). There were no transfers to the PICU because of a need for a higher level of care for behavioral interventions and no recorded behavioral escalations in the study group triggered by protocol restrictions.

**DISCUSSION**

The use of QI methodology to improve safety for adolescents admitted after a suicide attempt led to both a substantial and sustainable reduction in the rate of SSEs at our institution. At the conclusion of the study, we had gone more than 1 year between reported SSEs in our target population. Our 3 improvement interventions led to the routine use of the PBHSP and enhanced documentation of consent for mental health treatment. There have been many publications that describe the growing impact of pediatric mental health disorders and its implications for children’s hospitals and health care delivery systems as well as the challenges associated with treating this patient population in the acute-care setting. One of our study’s strengths is that we are among the first to demonstrate improved patient safety outcomes for this high-risk population through efforts to standardize care.

During the preimplementation period, our approach to the care of adolescents admitted after a suicide attempt was variable. This lack of a standard approach led to significant variability in care and a lack of a shared understanding of risk factors among care team members. Through our RCA of SSEs before the development of our behavioral health protocol, it became clear that our care teams did not adequately anticipate which patients would be at risk for SSEs or behavioral escalation. Standardizing admission procedures and management practices, including conducting safety searches and Safety Huddles, led to a systematic approach to all patients admitted after a suicide attempt regardless of perceived level of risk. As demonstrated in other settings, we believe standardizing care contributed significantly to our improved safety outcomes.

The process measure that our interventions did not significantly impact was the percent of patients with a completed safety search within 2 hours of admission (Fig 2C). The safety search is a chaotic process, and our efforts to standardize this work only made the system slightly less disordered. One possible cause for this is the participation of the bedside nurse in the Safety Huddle itself (see Supplemental Fig 6). The bedside nurse attends the Safety Huddle and has an important role in bringing up concerns with the care team. Confirmation that a safety search has been completed is also within the script of the Safety Huddle. Although the nurse participating in the Safety Huddle may not be the admitting nurse, the Safety Huddle process helped to increase nursing engagement and call out the importance of the safety search.

Although not directly assessed, we feel our interventions had a positive impact on the people caring for adolescents after a suicide attempt and the systems within which they work. This is supported by a recent Cochrane Review that found that improvements in interprofessional collaboration can result in better patient care. After our interventions, there is now less confusion among care team members with regards to what patients are allowed to do, and all team members are empowered to bring forth concerns during Safety Huddles. Nursing leadership has taken an active role in the maintenance of this work, and process improvements on the Safety Huddle and the safety search are the focus of unit-driven QI work. The Safety Huddle concept has spread to the pediatric ED, where the pediatric psychiatry service is now conducting daily Safety Huddles for patients boarding with behavioral and/or mental health complaints.

**LIMITATIONS**

Although we showed positive results toward improving safety outcomes for adolescents admitted after a suicide attempt, several important limitations should be mentioned. The study was conducted in a single-center,
medium-sized academic children’s hospital, thus potentially limiting its generalizability. The race and/or ethnicity characteristics between the pre- and postimplementation groups were statistically significant. We suspect this was due to the small sample size of our preimplementation group and higher percentage of Hispanic patients in the postimplementation group. Because of data acquisition constraints, 6 months of preimplementation data were collected, limiting the accuracy of determining baseline rates for process and outcome measures. Additionally, improvement interventions were variably implemented between the PICU and medical unit because of competing priorities. This may have been a contributing factor to the lack of improvement in safety search documentation noted in our run chart (Fig 2C). Finally, although systems for reporting SSEs exist within our institution, it is unclear if every SSE is reported. Building better tools for monitoring SSEs within this and other areas of patient safety remains a common challenge to hospital systems.

CONCLUSIONS

Through the development and implementation of a standardized approach to the care of adolescents hospitalized after a suicide attempt, we demonstrated a decrease in SSEs for this high-risk population. After the study period, unit-based and nurse-driven process improvement work is ongoing. We believe our protocol could be implemented at other hospitals that treat this patient population, resulting in safer, more equitable care. Additional studies that identify risk factors for behavioral escalation and safety events as well as the use of targeted interventions are warranted.

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