Standardizing and Improving Care for Pediatric Agitation Management in the Emergency Department

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abstract

BACKGROUND AND OBJECTIVES: Pediatric mental health emergency department (ED) visits are rising in the United States, with more visits involving medication for acute agitation. Timely, standardized implementation of behavioral strategies and medications may reduce the need for physical restraint. Our objective was to standardize agitation management in a pediatric ED and reduce time in physical restraints.

METHODS: A multidisciplinary team conducted a quality improvement initiative from September 2020 to August 2021, followed by a 6-month maintenance period. A barrier assessment revealed that agitation triggers were inadequately recognized, few activities were offered during long ED visits, staff lacked confidence in verbal deescalation techniques, medication choices were inconsistent, and medications were slow to take effect. Sequential interventions included development of an agitation care pathway and order set, optimization of child life and psychiatry workflows, implementation of personalized deescalation plans, and adding droperidol to the formulary. Measures include standardization of medication choice for severe agitation and time in physical restraints.

RESULTS: During the intervention and maintenance periods, there were 129 ED visits with medication given for severe agitation and 10 ED visits with physical restraint use. Among ED visits with medication given for severe agitation, standardized medication choice (olanzapine or droperidol) increased from 8% to 88%. Mean minutes in physical restraints decreased from 173 to 71.

CONCLUSIONS: Implementing an agitation care pathway standardized and improved care for a vulnerable and high-priority population. Future studies are needed to translate interventions to community ED settings and to evaluate optimal management strategies for pediatric acute agitation.

Mental health visits by children and adolescents to the emergency department (ED) are rising in the United States.[1,2] During these visits, children may develop acute agitation, which can lead to patients and staff injuries.[3] At US children's hospitals, intramuscular (IM) medication use for acute agitation management has tripled from 2009 to 2019, whereas 5% to 10% of pediatric mental health ED visits involve physical restraint.[4,5] However, the experience of being placed in restraints is psychologically distressing and may be unsafe, as evidenced by reports of pediatric deaths related to restraint use.[5–7] Thus, reducing agitation and restraint use are important patient safety goals.[8] Consensus guidelines suggest that timely implementation of behavioral strategies and medications may improve agitation and reduce the need for physical restraint.[9]

To improve care for pediatric acute agitation management, structured quality improvement (QI) methods have been employed in inpatient psychiatric and

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medical units, but these methods have not been applied in the ED.[10–13] Clinical decision support tools, such as care pathways and order sets, have successfully standardized and improved care for other pediatric emergency conditions,[14–17] but use of these tools for pediatric agitation care has been limited. Because excess variation in care contributes to inefficiencies, standardizing care for acute agitation management is a worthy goal.[18] In particular, standardizing medication choice for episodes of severe agitation may reduce delays in care, decrease restraint use, and prevent staff injuries.

The aim of this QI initiative was to standardize care for pediatric acute agitation management in the ED and reduce time in physical restraints. Through sequential interventions, including implementation of an agitation care pathway and order set, we aimed to standardize medication choice (to olanzapine or droperidol) for at least 60% of severe agitation episodes requiring medication, reduce use of the IM route for the first medication administered for acute agitation from 51% to 41%, and reduce mean time in physical restraints per episode by 20% (from 173 minutes to 138 minutes) by August 2021.

METHODS

Setting and Context

The study was conducted at an academic children's hospital with ~56 000 annual ED visits and 1500 annual mental health ED visits. Psychiatric social workers assist with mental health evaluations 24 hours per day. Child and adolescent psychiatrists and psychologists provide oversight and telephonic consultation for all cases. Child life specialists are available 11 hours per day. Three ED rooms have physical modifications to promote safety.

At baseline, physical restraints were used in only 0.1% of ED mental health visits at our hospital, whereas other centers have reported restraint use during 2% to 7% of pediatric mental health ED visits.[5,19] Consistent with national trends,[2,4] mental health visits and visits with medication given for acute agitation more than doubled during our intervention period (September 2020–August 2021) compared with baseline (September 2017–August 2020) (Table 1).

Planning the Interventions

In August 2019, we convened a multidisciplinary QI team consisting of pediatric emergency medicine physicians, child and adolescent psychiatrists, psychiatric social workers, ED nurses, pharmacists, a hospital data analyst, and a QI specialist. The team constructed a current state process map to understand steps in caring for children with acute agitation (Supplemental Fig 5) and a key driver diagram to develop aims and identify barriers to providing high-quality care (Fig 1). Barriers included: missed opportunities to proactively identify agitation triggers, long ED lengths of stay with few activities, low staff confidence in using deescalation techniques, delays in ordering medication because of practice variation in medication choice and limited familiarity with weight-based dosing, and slow time of onset of available medications. To inform interventions, the QI team reviewed current evidence on pediatric ED agitation management[9,20–22] and summarized findings.[3]

Interventions

The team conducted plan–do–study–act cycles to sequentially target barriers to high-quality agitation management by iteratively adjusting workflow processes.

Agitation Care Pathway

The QI team developed an ED agitation care pathway (Supplemental Fig 6), which directs clinicians to establish role assignments, implement environmental safety measures, determine the etiology and severity of agitation, and employ verbal deescalation techniques. The pathway provides guidance for medication choice and weight-based dosing. Olanzapine is recommended for severe agitation because of availability in both orally disintegrating tablet (ODT) and IM formulations, a lower incidence of extrapyramidal symptoms compared with first-generation antipsychotics,

TABLE 1 ED Visit Characteristics Before, During, and After Intervention Period

ED Visit Type	3-Year Period Before Interventions (September 2017–August 2020)	1-Year Intervention Period (September 2020–August 2021)	6-Month Sustainment Period (September 2021–February 2022)
Mental health ED visits (per mo)	109	127	158
ED visits with medication given for acute agitation[a] (per mo)	3.9	8.6	12.0
ED visits with medication given for severe agitation (per mo)	2.4	6.6	8.7
Mental health ED visits with physical restraints used, *N* (%)	5 (0.1)	9 (0.6)	1 (0.1)

[a] Of ED visits with medication given for acute agitation, 62% were by male patients, with median age 13 (interquartile range 10–15), and 43% had a diagnosis code for autism spectrum disorder, developmental delay/neurodevelopmental disorder, or intellectual disability on the basis of the Child and Adolescent Mental Health Disorders Classification System.[48,49]

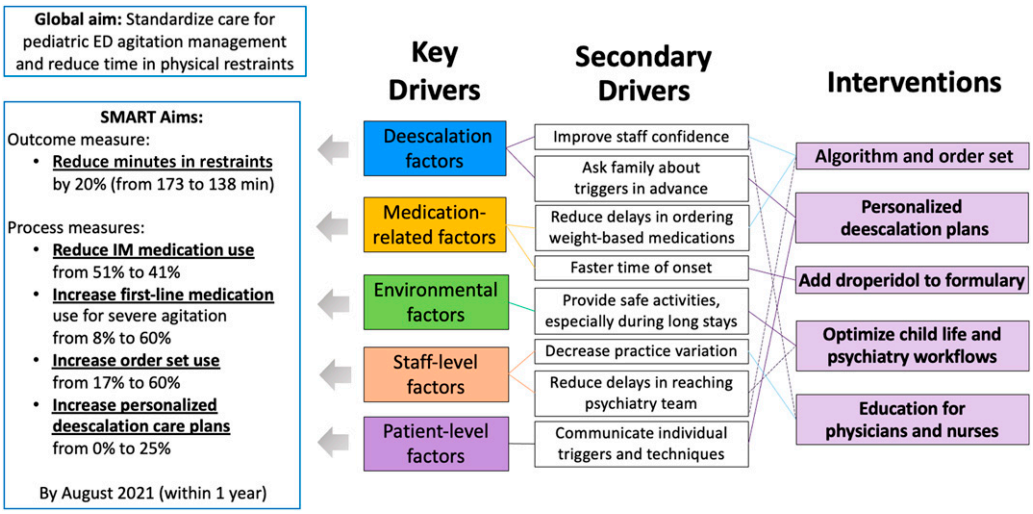

FIGURE 1
Key driver diagram indicating key drivers and interventions to improve pediatric acute agitation care.

and the simplicity of administering a single medication rather than a combination.[3] Physical restraints are recommended only if other measures are unsuccessful and when needed to ensure safety. Upon resolution of agitation, the pathway directs clinicians to develop a plan to prevent and manage re-escalation in consultation with the psychiatry team.

An electronic version of the agitation care pathway was added to a menu of institutional care pathways, accessible with 1 click from the ED patient track board. A printed version of the care pathway was displayed on a behavioral health cart containing physical restraints.

Agitation Order Set

We updated an existing psychiatric order set, previously used for management of ingestions, to include medications for agitation and physical restraints. Medications were nested in the order set by severity of agitation (moderate or severe) and then by patient weight ranges. Within each severity and weight category, recommended medications were preselected. The agitation care pathway and order set were implemented in September 2020, with education provided to ED clinicians and nurses during meetings and by e-mail. In October 2020, all medications in the care pathway were made available in the ED medication dispensing system, such that they could be withdrawn before pharmacy approval.

Optimized Workflows With Child Life and Psychiatry

In February 2021, we updated the care pathway to recommend consulting child life to provide coping strategies to prevent agitation. Also, we added information about child life activity carts that any ED staff member can use.

In April 2021, we optimized communication workflows with the psychiatry team to develop plans for difficult-to-control or recurrent agitation. The original workflow included the psychiatric social worker as an intermediary between the ED clinician and the psychiatrist. We added the on-call psychiatrist to the paging directory to allow for direct communication for urgent needs.

Personalized Deescalation Plans

We designed and implemented personalized deescalation plans to improve identification of patient-specific triggers for agitation and increase family involvement in care. In our first iteration in January 2021, psychiatric social workers embedded personalized deescalation plans within their notes, but ED clinicians found these difficult to access. In our second iteration in April 2021, we built a new behavioral support guidelines flowsheet embedded in the electronic health record (EHR). Psychiatric social workers were responsible for completing the flowsheet, which was modifiable by any ED team member. Plans displayed patient-specific information about baseline developmental skills and behaviors, routines for activities of daily living, escalation cues, prevention and deescalation techniques, preferred methods of medication administration, and recommended safety precautions including personal protective equipment. Plans carried forward across encounters and were accessible in the EHR by clicking a yellow banner under the patient's name.

Addition of Droperidol to the Hospital Formulary

For children with severe agitation, we identified administration of short-acting medication as a strategy to reduce the use of physical restraint. Our agitation care pathway recommended oral medication (specifically, olanzapine ODT) as first-line when possible, but limited cooperation may necessitate use of IM medications. Droperidol IM is a second-generation antipsychotic medication with a median time to sedation of

<15 minutes.[23,24] We conducted a systematic review that identified similar effectiveness and safety as other medications commonly in use, although studies were limited by small sample sizes and low quality.[25] Given its rapid onset, we added droperidol IM to the hospital formulary in August 2021, with corresponding updates to the care pathway and order set.

Study of Interventions

Measures

Because our baseline frequency of physical restraint use was already more than 10-fold lower than other centers,[5,19] we chose minutes spent in physical restraints per episode as our primary outcome measure. Process measures were:

1. the proportion of IM (as opposed to oral) route for the first medication administered for agitation during the ED visit;
2. administration of olanzapine ODT/IM (or droperidol IM, once available) for severe agitation, to measure standardization of medication choice;
3. order set use for agitation medications; and
4. documentation of personalized deescalation plans, after creation of a dedicated flowsheet for this purpose in April 2021.

Table 2 provides detailed measure definitions.

In accord with recent calls to align the fields of QI and implementation science,[26] we conducted a survey of ED clinicians to assess implementation outcomes for the ED agitation care pathway. From July to September 2021, we surveyed ED clinicians after ED visits with medication administered for acute agitation, using Research Electronic Data Capture hosted by Northwestern University.[27,28] We assessed implementation outcomes for the care pathway along Proctor model[29] domains: satisfaction with pathway content and features (acceptability); reported use of the pathway (adoption); goodness of fit with the clinician's practice (appropriateness); ease of use (feasibility); completion of pathway-recommended steps as intended (specifically, use of verbal deescalation strategies, personalized care plans, involvement of child life, and development of a contingency plan with psychiatry) as measures of fidelity; and awareness of the pathway (penetration). We also queried clinicians about remaining perceived barriers to care for children with agitation.

TABLE 2 Process and Outcome Measure Definitions

Measure	Measure Type	Numerator	Denominator	Desired Direction
Min in physical restraint per restraint episode	Outcome	Min between start and end time of physical restraint application	Episode of physical restraint use for violent or self-destructive behavior, indicated by clinician order or nursing flowsheet documentation	Decrease
IM medication used first	Process	IM (as opposed to oral) route for the first medication administered for acute agitation during the ED visit	ED visits with medication given for acute agitation[a]	Decrease
Choice of olanzapine or droperidol for severe agitation	Process	Administration of olanzapine ODT/IM or droperidol IM	ED visits with medication given for severe agitation[b]	Increase
Order set use	Process	Agitation order set used to order medication for acute agitation management	ED visits with medication given for acute agitation[a]	Increase
Personalized care plans	Process	Personalized care plan in place for acute agitation management, including patient-specific triggers and deescalation strategies, embedded in the EHR	ED visits with medication given for acute agitation[a]	Increase

[a] ED visit with medication given for acute agitation defined by:
1. ED visits with IM administration of diphenhydramine, lorazepam, olanzapine, haloperidol, chlorpromazine, or droperidol; or
2. ED visits with a psychiatric chief complaint and oral administration of diphenhydramine, lorazepam, or olanzapine.

[b] ED visit with medication given for severe agitation defined by:
1. IM administration of diphenhydramine, lorazepam, olanzapine, haloperidol, chlorpromazine, or droperidol; or
2. oral administration of olanzapine and a psychiatric chief complaint for the ED visit.

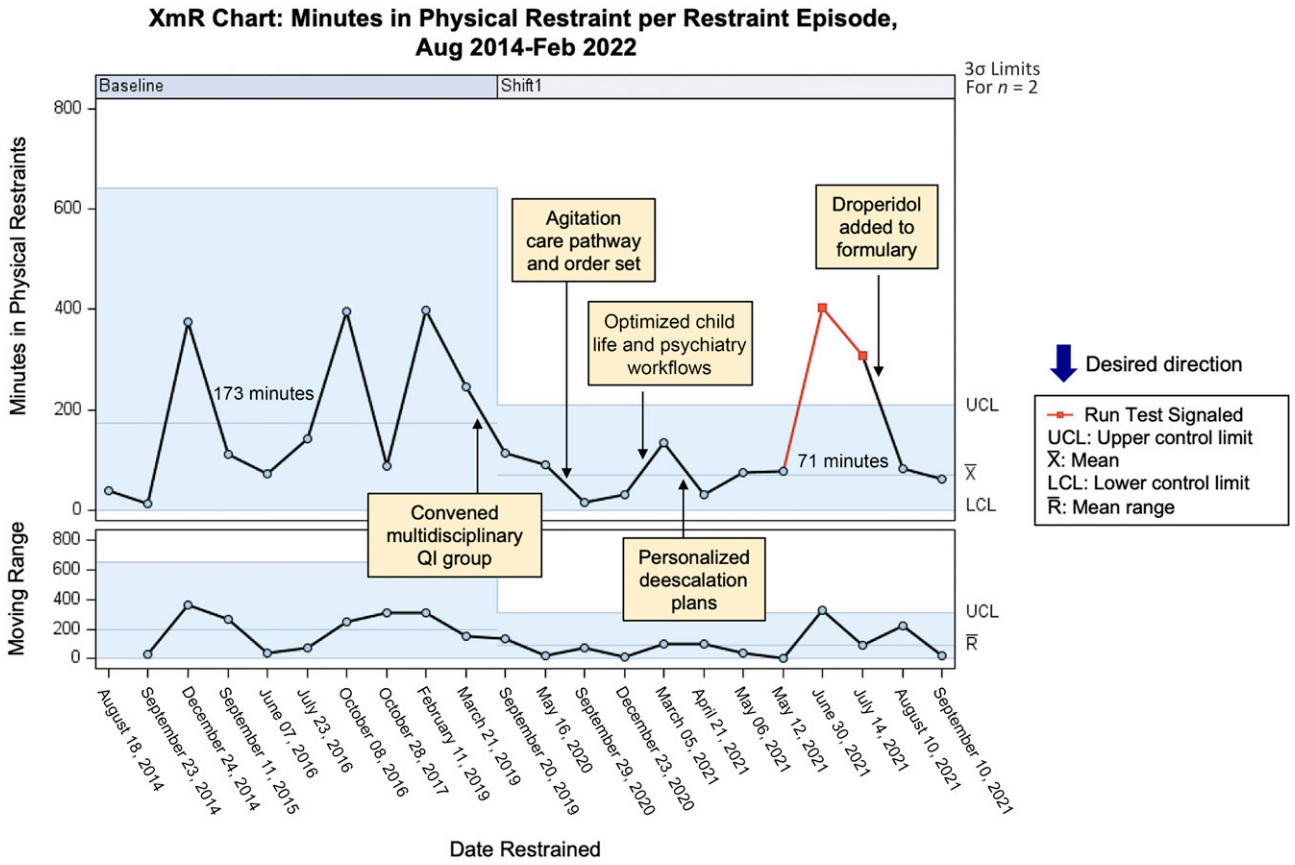

FIGURE 2

Individual and moving range (XmR) chart: Minutes in physical restraint per restraint episode, August 2014 to February 2022. Each point in the top panel represents the duration of physical restraint use in minutes for a single episode of physical restraint use. The centerline was calculated using data from August 2014 to August 2020 to establish an estimate of baseline minutes in restraint per episode before the intervention period. The lower panel displays the moving range.

Analysis

Data were extracted quarterly to monitor and evaluate process adherence and outcomes. We used run charts to assess the impact of interventions on process measures, with centerlines reset according to standard rules.[30] Given the infrequency of restraint episodes, we constructed an individuals and moving range chart to monitor minutes in restraint per episode.[30] We used descriptive statistics to characterize survey responses.

Ethical Considerations

This study was reviewed and determined not human subjects research by the institutional review board.

RESULTS

During the 1-year intervention period (September 2020–August 2021) and 6-month maintenance period (September 2021–February 2022), there were 161 ED visits with medication given for agitation, 129 ED visits with medication given for severe agitation, and 10 ED visits with physical restraint use.

Physical Restraint Use

The baseline mean time in physical restraints was 173 minutes per episode. After the multidisciplinary QI group convened, a centerline shift occurred, with the mean decreasing to 71 minutes (a reduction of 59% from baseline) (Fig 2). In June to July 2021, 2 outlier cases had prolonged restraint times; both patients had severe agitation that was unresponsive to initial medications, requiring multiple medications over several hours. No further cases of prolonged restraint use occurred after droperidol became available.

Intramuscular Medication

The baseline mean percentage of using an IM route for the first agitation medication administered during the ED visit was 51%. During the intervention period, this percentage varied from 21% (after implementation of the agitation care pathway and order set) to 48% (when

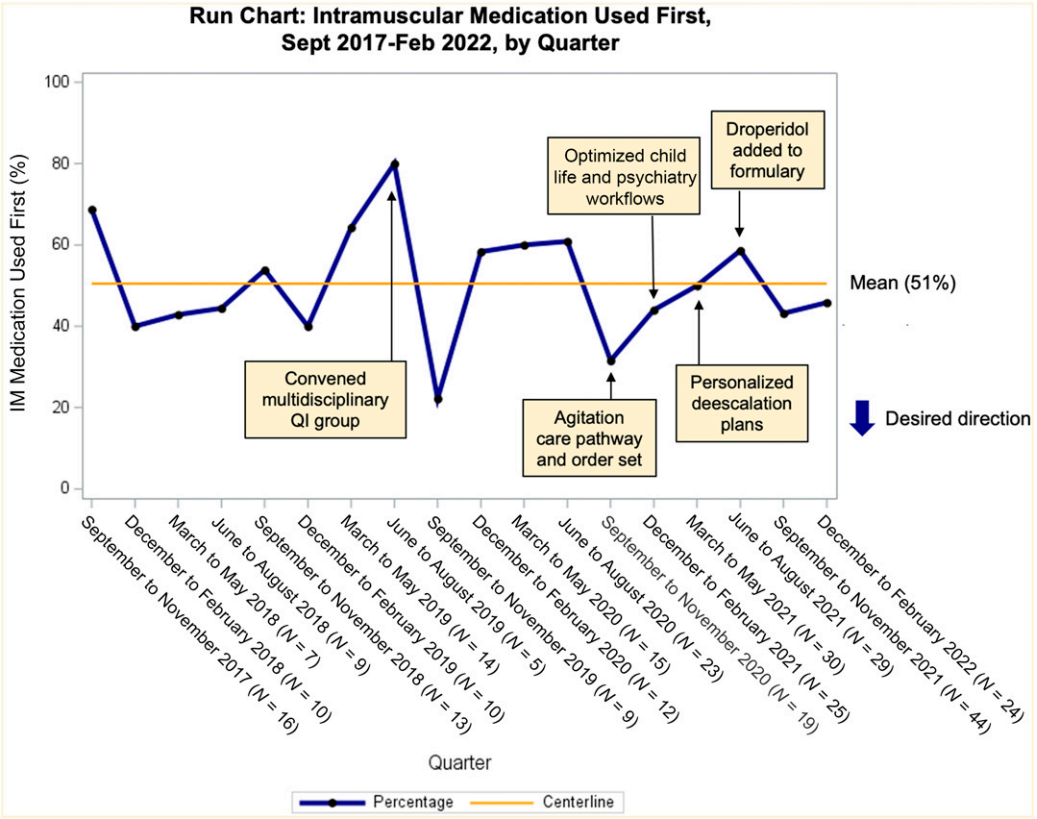

FIGURE 3

Run chart: Intramuscular medication used first, September 2017 to February 2022, by quarter. Numerator: Intramuscular (as opposed to oral) route for the first medication administered for acute agitation during the ED visit. Denominator: ED visits with medication given for acute agitation.

droperidol IM was added to the hospital formulary), but the centerline did not shift (Fig 3).

Use of Olanzapine or Droperidol for Severe Agitation

Among ED visits with medication given for severe agitation, use of olanzapine or droperidol increased from a baseline mean of 8% to 39% after the interdisciplinary QI team first convened (Fig 4). Use of olanzapine or droperidol increased further to 88% upon implementation of the agitation care pathway and order set, which was sustained during the maintenance period.

Order Set Use

Order set use for agitation medications rose from a baseline mean of 17% to 56% during the intervention period, which was sustained during the maintenance period (Supplemental Fig 7).

Personalized Deescalation Plans

Documentation of personalized deescalation plans occurred during 27% of ED visits with medication given for agitation, from the time these plans were first implemented in April 2021 through the maintenance period (Supplemental Fig 8).

ED Clinician Survey Results: Implementation Outcomes

Thirty-five surveys were completed by ED clinicians after ED visits with medication given for acute agitation (response rate 90%). Implementation outcomes indicated high rates of adoption (92%) of the agitation care pathway, with varying fidelity to individual steps (Supplemental Table 3). The most frequently reported barriers to caring for children with agitation using the agitation care pathway were ineffectiveness of verbal deescalation (69%), long length of stay (39%), lack of availability of child life services (16%), and the presence of multiple patients in adjacent rooms escalating each other (8%).

DISCUSSION

A multidisciplinary QI initiative resulted in improved care for pediatric acute agitation in the ED, with standardization of medication choice for severe agitation and reduced time in restraints. The success of this QI effort resulted from multiple interventions, including development of an agitation care pathway and order set, optimization of workflows with child life and psychiatry, implementation of personalized deescalation plans embedded in the

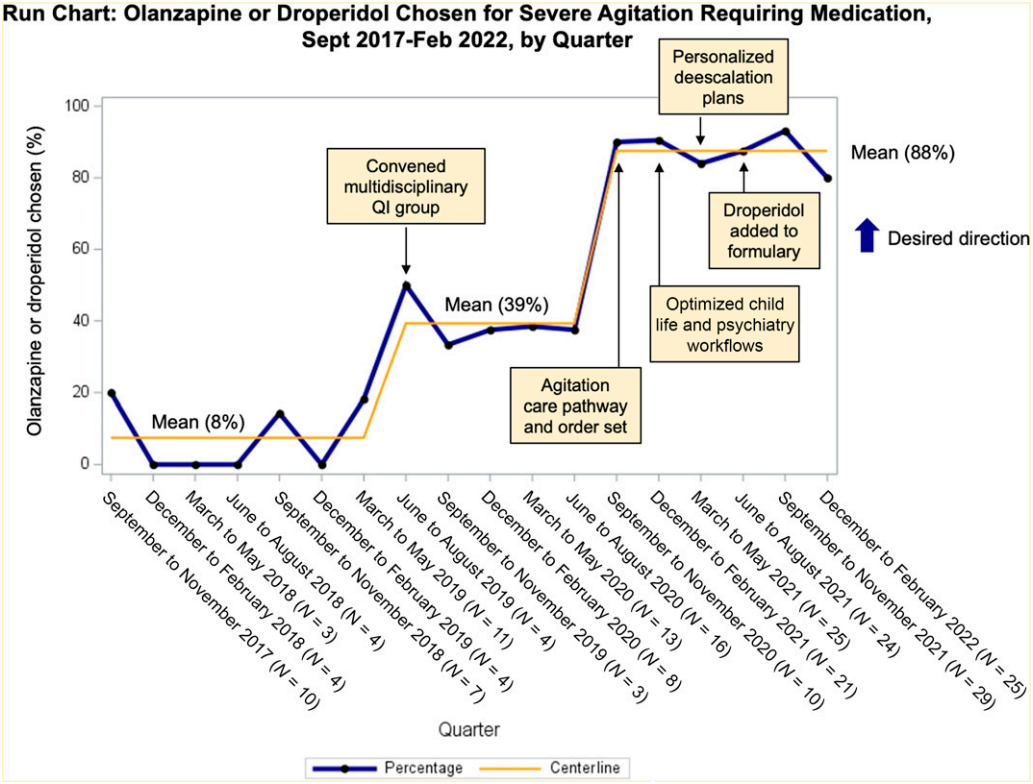

FIGURE 4

Run chart: Olanzapine or droperidol chosen for severe agitation, September 2017 to February 2022, by quarter. Numerator: Administration of olanzapine or droperidol. Denominator: ED visits with medication given for severe agitation, defined by:
1. IM administration of diphenhydramine, lorazepam, olanzapine, haloperidol, chlorpromazine, or droperidol; or
2. oral administration of olanzapine and a psychiatric chief complaint for the ED visit.

electronic medical record, and addition of droperidol to the hospital formulary. Clinical decision support tools, namely the clinical pathway and order set, appeared to be the largest drivers of change.

Previous QI efforts have focused on reducing restraint use in inpatient pediatric psychiatric units, inpatient general pediatric medical wards, and in adult EDs,[13,31,32] but, to our knowledge, we are the first to use QI methods to improve pediatric acute agitation care in the ED. One previous retrospective study evaluated an acute agitation algorithm in a pediatric ED. In this study, rates of physical restraint use did not differ during ED visits that adhered to medication recommendations in the algorithm compared with visits that deviated from the algorithm.[33] In contrast, implementation of our comprehensive agitation care pathway, along with other interventions, reduced the mean time that children spent in physical restraints.

We did not meet our aim of reducing medication delivery via the IM route. We defined this measure using the first medication delivered during the ED visit, because we hypothesized that children might be more amenable to accept oral medication when agitation is identified early and is less severe. We encouraged use of oral medications by recommending them in the care pathway and preselecting oral medications in the order set. Despite these interventions, reasons for continued use of IM medications may have included lack of patient cooperation, high severity level of agitation, concerns that oral medications may increase risk for patient/staff injury because of their slower onset, and perceived ineffectiveness of oral medications. After introduction of droperidol, use of IM medications transiently increased, possibly because of perceived effectiveness of this medication or a desire to try a new approach.

Our team recently conducted a consensus process with multidisciplinary ED care team members and parents to identify quality measures considered important for pediatric acute agitation management.[34] Interestingly, the panel did not rank the route of medication administration as highly important. In contrast, the panel reached consensus that having an algorithm in place and the duration of time spent in physical restraints were both highly important measures of the quality of care provided for pediatric agitation management.[34]

We found value in using an implementation science framework to evaluate implementation outcomes for the

agitation care pathway.[26] ED clinicians reported high rates of adoption of the care pathway and good perceived fit for practice, although adherence was low for some components. In particular, few ED clinicians reported viewing personalized deescalation plans, suggesting a need for further refinement of these plans to increase their relevance and accessibility, perhaps through user-centered design.[35,36] Also, clinicians reported involving child life specialists in <1 in 5 cases for initiation of preventive interventions. Development of tools to identify children at risk for developing acute agitation in the ED visit might facilitate earlier linkage to child life services and other preventive approaches.

At the conclusion of our intervention period, perceived ongoing barriers to care included ineffective verbal deescalation strategies and long lengths of stay. Perceived inadequacy of verbal deescalation may relate to inadequate training or a high severity level of agitation.[37] Interdisciplinary simulation curricula have been developed to allow ED team members to practice verbal deescalation skills.[38,39] Additionally, behavioral rapid response teams, which bring personnel trained in deescalation strategies rapidly to the bedside, have resulted in improved staff confidence and decreased restraint use.[40–43] Because lengths of stay for pediatric mental health ED visits have increased over time, with some children boarding for days awaiting inpatient psychiatric care,[44,45] providing safe activities may prevent acute agitation. In EDs without child life services, self-directed, low-cost activities are available for children with mental health conditions.[46,47]

LIMITATIONS

Because no prospective observational studies or randomized controlled trials have compared the effectiveness of medications for acute agitation in children, the development of our agitation care pathway was informed by low-quality evidence.[3] To enhance sustainability of measurement, we chose to measure aspects of care routinely captured in the EHR. Therefore, we could not determine if our interventions resulted in increased use of verbal deescalation strategies, more frequent involvement of child life, or more timely psychiatric consultation, each of which may have driven change. For the same reason, we could not accurately capture adverse medication effects to include as a balancing measure. We were unable to include staff injuries as a balancing measure because of underreporting, with only 1 reported injury because of aggressive patient behavior in the ED during the study period. Improving injury reporting is a future goal of our team. Additionally, documentation of personalized deescalation plans did not guarantee their use during episodes of agitation. We did not have sufficient case numbers to analyze results stratified by race, ethnicity, or preferred language. Because our QI initiative was implemented at a single institution, some of our interventions may have limited generalizability to hospitals without access to child life specialists, psychiatric social workers, or child and adolescent psychiatrists.

CONCLUSIONS

Implementation of a multidisciplinary QI initiative resulted in standardization of medication choice for acute agitation in children in the ED and reduced time spent in physical restraints. The interventions that led to the most marked and sustained improvements were clinical decision support tools, in the form of a care pathway and order set. We also implemented novel EHR-based personalized deescalation plans that carry forward across encounters. Future studies are needed to determine which medications are most effective for acute agitation in children. Our approach may be helpful to other institutions currently lacking a standardized approach to pediatric acute agitation management and who wish to improve care for this vulnerable and high-priority population.

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ABBREVIATIONS

ED: emergency department
EHR: electronic health record
IM: intramuscular
ODT: orally disintegrating tablet
QI: quality improvement

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