A SPECIAL ARTICLE

A Clinical Pathway to Standardize Care of Children With Delirium in Pediatric Inpatient Settings

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ABSTRACT

Pediatric delirium is an important comorbidity of medical illness in inpatient pediatric care that has lacked a consistent approach for detection and management. A clinical pathway (CP) was developed to address this need. Pediatric delirium contributes significantly to morbidity, mortality, and costs of inpatient care of medically ill children and adolescents. Screening for delirium in hospital settings with validated tools is feasible and effective in reducing delirium and improving outcomes; however, multidisciplinary coordination is required for implementation. The workgroup, composed of international experts in child and adolescent consultation psychiatry, reviewed the literature and developed a flowchart for feasible screening and management of pediatric delirium. When evidence was lacking, expert consensus was reached; stakeholder feedback was included to create the final pathway. A CP expert collaborated with the workgroup. Two sequential CPs were created: (1) “Prevention and Identification of Pediatric Delirium” emphasizes the need for systematic preventive measures and screening, and (2) “Diagnosis and Management of Pediatric Delirium” recommends an urgent and ongoing search for the underlying causes to reverse the syndrome while providing symptomatic management focused on comfort and safety. Detailed accompanying documents explain the supporting literature and the rationale for recommendations and provide resources such as screening tools and implementation guides. Additionally, the role of the child and adolescent consultation-liaison psychiatrist as a resource for collaborative care of patients with delirium is discussed.

www.hospitalpediatrics.org

DOI: https://doi.org/10.1542/hpeds.2019-0115

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HOSPITAL PEDIATRICS (ISSN Numbers: Print, 2154-1663; Online, 2154-1671).

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: Supported by the Abramson Fund of the American Academy of Child and Adolescent Psychiatry and the Intramural Research Program (ZIA MH002922-10) of the National Institute of Mental Health of the National Institutes of Health.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

Drs Silver and Kearney organized and led pathway development, drafted sections and assembled the initial manuscript, and coordinated all edits and revisions; Drs Bora, De Souza, Giles, Hryko, Jenkins, Malas, Namerow, Ortiz-Aguayo, and Russell participated in pathway development, drafted sections of the initial manuscript, and reviewed and revised edits; Drs Pao and Plioplys conceptualized and designed the overall pathway project and critically reviewed the manuscript; Dr Brahmbhatt conceptualized and designed the overall pathway project, participated in pathway development, drafted sections of the initial manuscript, and reviewed and revised edits; and all authors approved the final manuscript as submitted.

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Delirium is a well-described syndrome of acute brain dysfunction associated with underlying physical illness. It involves an acute change in baseline awareness, and onset of altered behavior or cognition, with a fluctuating course. Current pathophysiologic models explain delirium symptoms as the result of disturbances within the neuroendocrine and inflammatory pathways triggered by an underlying physiologic disturbance, such as a systemic or neurologic medical condition, or iatrogenic causes, such as use of sedatives, substance intoxication, or withdrawal. Current understanding of pediatric delirium is extrapolated from robust adult literature and supported by expanding pediatric literature.

Delirium can occur in any setting but is most prevalent in the inpatient setting, predominately in the critical care setting, because of worsening clinical disease and exposure to pharmacologic agents that can exacerbate delirium, such as benzodiazepines or anticholinergics. Prevalence rates are ~20% to 44% in PICU settings, according to US studies. The inpatient environment can confer risks for the development of delirium due to noise and overstimulation, causing frequent disruptions in rest and sleep. Validated screening tools have recently become available and are feasible for implementation in detecting pediatric delirium. Tools include the Pediatric Confusion Assessment Method for the ICU (psCAM-ICU), the Preschool Confusion Assessment Method for the ICU (psCAM-ICU), and the Cornell Assessment of Pediatric Delirium (CAPD).

Pediatric delirium can have significant impacts on morbidity, mortality, and financial costs. Delirium increases length of stay in pediatric critical care settings and length of mechanical ventilation by 2 to 3 days and is an independent predictor of mortality (adjusted odds ratio 4.39; P < .001). Hospital costs of youth with delirium are >4 times the cost of similar youth without delirium ($18,832 vs $4803; P < .0001), with incremental increases in cost seen with each day a child remains delirious. Controlling for age, sex, severity of illness, and pediatric critical care length of stay, delirium is associated with an 85% increase in hospitalization costs. Beyond short-term effects on hospital outcomes, delirium studies in adults show significant cognitive, emotional, and behavioral impacts beyond the hospital stay. In a systematic review and meta-analysis of 5280 adult patients with delirium, there was an association between the presence of delirium and a decline in cognitive outcomes. Long-term outcome research in pediatric delirium is needed. A significant minority (nearly one-third) of pediatric patients with delirium describe posttraumatic stress symptoms up to 3 months after hospitalization. A recent study of cognitive function in PICU survivors did not find an association between delirium and impaired cognition, although the survivors did have lower IQ as a group compared with the normal population, and the study was limited by design, using normative scales only and lacking controls or baseline evaluations for subjects.

Despite the negative outcomes associated with pediatric delirium, there is a lack of standardization of prevention, evaluation, and management. For problems like delirium, clinical pathways (CPs) can be an effective means of standardizing care by translating current literature and expert consensus into clinical practice. Although they have been increasingly used in pediatric diseases ranging from community-acquired pneumonia to cystic fibrosis, there has been limited use of CPs to address complex conditions at the interface of pediatric medicine and psychiatry, such as in the case of delirium. CP use has resulted in decreased length of stay, reduced health care use and costs, reduced use of unnecessary diagnostic practices and interventions, reduced recidivism, and improved quality of care. They anchor the interdisciplinary care teams, as well as families, to aligned expectations and principles for care. They also allow for clinician judgment and do not provide a rigid, overly prescriptive approach. Factors that predict successful CP implementation include high disease prevalence, significant disease impact on patient outcomes, high practice variability, and broad, multidisciplinary care involvement.

The goal of standardizing pediatric delirium care in this way is to improve outcomes, prevent delirium, decrease length of stay and invasive interventions (such as prolonged mechanical ventilation or extended sedation use), reduce cost, improve quality of life, and enhance patient, family, and provider satisfaction with care.

The current study describes the process and content development of a CP for inpatient pediatric delirium care developed through evidence-based review, broad stakeholder feedback, and expert consensus by a representative group of child and adolescent consultation-liaison psychiatrists in the United States and Canada.

METHODS
The Pathways for Clinical Care (PaCC) Workgroup has described the overall process of developing 3 pediatric consultation-liaison CPs using an established model for CP creation.

Identifying the Need for a CP
Factors that may make a condition appropriate for successful pathway development include the following. (1) Either high-volume, common conditions or if low-volume condition is high risk: Delirium meets both conditions when it is prevalent in inpatient settings, namely critical care, and when not as prevalent (general pediatric hospitalized population), it may indicate new-onset central nervous system comorbidities or be a harbinger of critical systemic complications (eg, sepsis). (2) Strong evidence base: There is strong evidence for screening and a fair evidence base for management from adult research with growing pediatric evidence. (3) High variation in practice: This was affirmed by the varied experiences the authors had when implementing best practices for pediatric delirium at their own institutions and stakeholder feedback obtained from multistitutional inpatient pediatric care providers. A lack of standardized screening, institutionally based patterns of prescribing drugs (deemed either useful or taboo) for pediatric patients with delirium, and even cross-disciplinary differences in diagnostic language and recognition of delirium.
Assembling a Team of Experts
The subgroup coleaders have an established clinical and research expertise in pediatric delirium as authors of the CAPD and other seminal peer-reviewed publications. The 13 subgroup members practice in a variety of consultation-liaison settings in 7 US states and 2 Canadian provinces, work mainly in medium or large academic acute medical centers, and have some variation in resources and practice patterns. All members volunteered to participate in the pathway development initiative.

Starting in 2016, the subgroup met regularly over 2 years, primarily through teleconferences (~28 calls and 4 in-person meetings). Work was conducted by individual members and shared with the group for discussion and consensus generation. To establish a shared baseline level of knowledge and understanding, the co-leaders facilitated telephone-based training and dialogue on screening and management of delirium based on a review of the literature and the leaders’ previous work. Iliana Waynik, MD, a pediatric hospitalist and clinical educator with expertise in CP generation, provided ongoing guidance about pathway development over the 2 years.

Compiling and Reviewing Background Research
The literature on pediatric delirium was compiled, reviewed, and used to inform and structure steps in the pathway. Subgroup members shared current practices, guidelines, and protocols (as available) from their individual institutions, which further influenced the common, foundational elements of the pathway. When evidence was limited, consensus discussions by subgroup experts contributed to elaboration of some pathway recommendations.

Developing the CP
On the basis of literature review and clinical consensus discussions, the subgroup drafted an outline of the key pathway steps and drafts of the pathway documents. Feedback and revisions were done iteratively at 3 key points with different audiences: (1) The initial drafts were shared with the members of the larger PaCC Workgroup and Dr Waynik, the CP expert, at a face-to-face workshop retreat made possible by an American Academy of Child and Adolescent Psychiatry (AACAP) Abramson Fund grant obtained for the initiative. (2) The pathway was then presented and discussed at the AACAP October 2017 Annual Meeting and Member Services Forum in Washington, District of Columbia. Audience responses on language, format, and implementation strategies informed further refinement of the suite of documents. (3) Finally, the pathway was shared with multidisciplinary stakeholders representing a range of fields, including pediatric critical care, advanced practice nursing, bedside nursing, physiotherapy, and pharmacy, and a parent from members’ hospitals by using a questionnaire devised by the subgroup to elicit feedback. Responses were summarized, considered by members, and incorporated into the pathway documents if consistent with the pathway goals and evidence base.

RESULTS
The products of the described consensus process are a suite of complementary documents including 2 flowcharts (Figs 1 and 2) and two text documents: “Introduction to the Delirium Pathway” and “Guide to the Delirium Pathway” (Supplemental Information). Many aspects of the intervention are flexible to local preferences and practice, which may vary according to resources. The flowcharts intentionally include detailed information on nonpharmacologic prevention and intervention so that these documents could serve as stand-alone clinical or educational resources with end-user ease in mind.

DISCUSSION
Delirium is a disabling and prevalent condition among hospitalized children. Increasing recognition of pediatric delirium by clinicians reveals concerns about appropriate assessment and treatment. To promote a more standardized approach to care, we present a consensus-driven, evidence-based CP on the detection and management of pediatric delirium in inpatient settings.

When possible, empirical evidence was included to inform each pathway recommendation. When no evidence was found, the rationale supporting the inclusion of each consensus recommendation is described in the guide. Consensus discussions took into account values and priorities such as patient safety, illness prevention, early identification, patient-centered care, family systems interventions, and multidisciplinary and/or team-based practice.

Given that inpatient care, and thus delirium evaluation and management, is multidisciplinary by nature, documents were created with input from multidisciplinary stakeholders and written to acknowledge the different audiences, such as nursing, physician specialists (e.g., critical care and neurology), rehabilitation, pharmacy, and administration. This inclusive approach recognizes that successful implementation of a new CP requires education, participation, and buy-in from all relevant disciplines. The complementary pathway documents were designed to address the varying needs of the stakeholder groups. For example, the pathway flowchart is a simplified, easy-to-read, bedside reference tool (Figs 1 and 2), whereas the accompanying narrative, “Guide to the Pathway” in the Supplemental Information, presents a more comprehensive, in-depth description of each step and its underlying rationale.

The pathway is designed to provide an overall guide, not a prescriptive methodology, for pediatric institutions.
FIGURE 1  Pediatric Delirium Pathway I: Prevention and Identification. OT, occupational therapy; PT, physical therapy.
focused on improving delirium evaluation and management. It was challenging to ensure the “best” balance between standardization of recommendations and potential for setting-specific customization of recommendations. Because institutions have heterogeneous needs, resources, and populations, the pathway is amenable to modification and refinement by local care
systems and institutional workgroups. The pathway indicates when and where it is recommended to engage psychiatry; when and how this occurs may become setting specific because of the availability of consultation-liaison psychiatry in different hospitals. Another example of adaptation potential is the promotion of the use of whichever validated delirium screening tool best meets an institution’s needs. Additionally, pathway elements may be revised for discipline-specific policies (e.g., nursing policies may be written to include parameters for bedside screening, and environmental interventions nurses can implement for prevention and management).

Implementation of the pathway can be led by leadership in child and adolescent consultation-liaison psychiatrists, pediatric intensivists or hospitalists, or pediatric nurses and requires champions in all disciplines. As child and adolescent consultation-liaison psychiatrists, we believe this clinical area offers a unique leadership opportunity for members of our field. Through the process of successful implementation of the Pediatric Delirium Pathway, the psychiatrist can offer valuable expertise toward an education and training program, the development of delirium order sets, and the identification of quality metrics for ongoing review and improvement. The insights a psychiatrist brings to the differential diagnosis of delirium, the developmental presentation of symptoms in children, and the appropriate use of antipsychotics in medically ill children will help ensure safe and meaningful implementation of the pathway. An added benefit of leading these initiatives in our own institutions has been the fuller integration of consult-liaison psychiatry teams into the PICU and other medical units. One limitation in the process of pathway development was the lack of published evidence for many recommendations. Although the quality of evidence was considered, a formal Preferred Reporting Items for Systematic Reviews and Meta-analysis systematic review was not completed for this study. Another limitation is the lack of a systematic, blinded approach to reach expert consensus for clinical management, such as the Delphi method. Additionally, because a review of quality metrics has not yet been done, there is no assurance that adherence to these recommendations will bring improved outcomes for delirium care.

Future steps for this pathway initiative include the design of multiinstitutional studies to examine implementation processes and the impact on patient, provider, and system outcomes. Examination of rates of adherence to the pathway may help us better understand barriers to and facilitators of pathway implementation. Studying outcomes such as changes in delirium prevalence, sources of delirium, delirium interventions used, length of stay, morbidity, and mortality may help elucidate the clinical benefits and drawbacks of pathway implementation. Revisions to this pathway based on emerging research are to be expected and will require ongoing collaboration between pediatrics, nursing, and child and adolescent psychiatry. The concept of CPs is still relatively new in psychiatry, especially when it targets psychiatric or behavioral problems in hospital-based pediatric medical and/or surgical contexts. This delirium pathway represents a promising example of how psychiatric CPs may promote improvement of quality of care in inpatient pediatric hospital settings.

**CONCLUSIONS**

We propose a CP representing a distillation of current literature and expert consensus in screening, evaluation, and management of pediatric delirium. This pathway is designed to be adapted to fit individual institutions and foment a multidisciplinary approach while encouraging consultation-liaison child and adolescent psychiatry leadership and integration. Ongoing research regarding pathway implementation, outcomes, and continued process improvement is warranted.

**Acknowledgments**

In addition to the authors of this article, the PaCC Workgroup includes Patricia Ibeziako, MD, Lisa Horowitz, PhD, Andrea Chapman, MD, Shanti Gooden, MD, Finza Latif, MD, Petra Steinbuchel, MD, Khalid Afzal, MD, Kyle Johnson, MD, Elizabeth Kowal, MD, and Brian Kurtz, MD. The authors thank graphic designer Kathleen Saminy for her invaluable collaboration in this pathway development.

**REFERENCES**

8. Barnes SS, Grados MA, Kudchadkar SR. Child psychiatry engagement in the management of delirium in critically ill...


38. Singh SB, Shelton AU, Greenberg B, Størner TD. Implementation of cystic fibrosis clinical pathways improved physician adherence to care


56. Silver G, Kearney J. Detecting and diagnosing pediatric delirium with the application of standardized clinical tools: the how and the why. In: Proceedings from the Academy of Child and Adolescent Psychiatry 62nd Annual Meeting; October 30, 2015; San Antonio, TX

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Hospital Pediatrics 2019;9;909

DOI: 10.1542/hpeds.2019-0115 originally published online October 29, 2019;

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