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REVIEW ARTICLE/BRIEF REVIEW

Comfort-holding in critically ill children: a scoping review

Les étreintes de réconfort chez les enfants gravement malades : une étude de portée

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Abstract

Purpose *To understand and summarize the breadth of knowledge on comfort-holding in pediatric intensive care units (PICUs).*

Sources *This scoping review was conducted using PRISMA methodology. A literature search was conducted in MEDLINE, EMBASE, PsycINFO, CINAHL, and the Cochrane CENTRAL Register of Controlled Trials. Search strategies were developed with a medical librarian and revised through a peer review of electronic search strategies. All databases were searched from inception to 14 April 2020. Only full-text articles available in English were included. All identified articles were reviewed independently and in duplicate using predetermined criteria. All study designs were eligible if they reported on comfort-holding in a PICU. Data were extracted independently and in duplicate.*

Principal findings *Of 13,326 studies identified, 13 were included. Comfort-holding was studied in the context of end-of-life care, developmental care, mobilization, and as a unique intervention. Comfort-holding is common during end-of-life care with 77.8% of children held, but rare during acute management (51% of children < three years, < 5% of children ≥ three years). Commonly reported outcomes included child outcomes (e.g., physiologic measurements), safety outcomes (e.g., accidental line*

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removal), parent outcomes (e.g., psychological symptoms), and frequency of holding.

Conclusion *There is a paucity of literature on comfort-holding in PICUs. This scoping review identifies significant gaps in the literature, including assessment of child-based outcomes of comfort-holding or safety assessment of comfort-holding, and highlights core outcomes to consider in future evaluations of this intervention including child-based outcomes, parent-based outcomes, and safety of the intervention.*

Résumé

Objectif *Comprendre et résumer l'étendue des connaissances sur la pratique des étreintes de réconfort dans les unités de soins intensifs pédiatriques (USIP).*

Sources *Cette étude de portée a été réalisée en utilisant la méthodologie PRISMA. Une recherche de la littérature a été menée dans les bases de données MEDLINE, EMBASE, PsycINFO, CINAHL et dans le registre Cochrane CENTRAL d'études contrôlées. Les stratégies de recherche ont été élaborées avec un bibliothécaire médical et révisées au moyen d'un examen par les pairs des stratégies de recherche électronique. Toutes les bases de données ont été passées en revue de leur création au 14 avril 2020. Seuls les articles en texte intégral disponibles en anglais ont été inclus. Tous les articles identifiés ont été révisés indépendamment et en double à l'aide de critères prédéterminés. Tous les types de plans d'étude étaient admissibles s'ils abordaient le thème des étreintes de réconfort dans une USIP. Les données ont été extraites indépendamment et en double.*

Constatations principales *Sur les 13 326 études identifiées, 13 ont été incluses. Les étreintes de réconfort ont été étudiées dans le contexte des soins de fin de vie, des soins développementaux, de la mobilisation et en tant qu'intervention unique. Les étreintes de réconfort sont une approche courante dans le cadre de soins de fin de vie, durant lesquels 77,8 % des enfants sont étreints, mais plus rares pendant la prise en charge aiguë (51 % des enfants < trois ans, < 5 % des enfants ≥ trois ans). Les résultats couramment rapportés comprenaient les issues pour les enfants (p. ex. mesures physiologiques), les issues en matière de sécurité (p. ex. retrait accidentel d'une ligne), les issues pour les parents (p. ex. symptômes psychologiques) et la fréquence des étreintes.*

Conclusion *Il n'existe que très peu de littérature s'intéressant aux étreintes de réconfort dans les USIP. Cette étude de portée identifie d'importantes lacunes dans la littérature, notamment l'évaluation des issues pour l'enfant suite à une étreinte de réconfort ou l'évaluation de la sécurité de telles étreintes, et met en évidence les issues principales dont il faudra tenir compte dans les évaluations futures de cette intervention, y compris les issues axées sur l'enfant, les issues basées sur les parents et la sécurité de l'intervention.*

Keywords critical care · pediatrics · intensive care unit · comfort-holding · non-pharmacological therapy · delirium

Advances in diagnosis and therapy have resulted in decreased mortality rates[1] for children admitted to pediatric intensive care units (PICU); despite this, survivors and their families continue to face significant physical and psychological stress both during and following their PICU admission.[2–8] Pain and agitation are commonly experienced by critically ill children due to both underlying disease processes and life-sustaining therapies.[9–11] Uncontrolled pain and agitation are associated with both short- and long-term negative sequelae including delirium, anxiety, post-traumatic stress, and chronic pain syndromes.[12–20] Currently, pharmacologic interventions are the standard of care to address patients' physical and psychological comfort.[13,19,21–23] Nevertheless, these are associated with negative short- and long-term effects, including neurotoxicity, delirium, prolonged PICU length of stay, and long-term neurocognitive effects for infants and children.[8,13,24–27] Thus, it is important to explore non-pharmacologic therapies for preventing and managing pain and agitation in the PICU.

Comfort-holding (e.g., skin-to-skin, kangaroo care, and clothed cuddling) is well established as an effective therapy in critically ill neonates[28–35] and is associated with improved autonomic stability, decreased pain, and decreased cortisol levels.[36,37] Neonates who are held while in the neonatal intensive care unit have improved self-regulation and better long-term cognitive

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development.[38] The efficacy of holding and touch has been well established in the neonatal literature and adult neuropsychological literature, with reductions in pain and anxiety well into adulthood.[39–43] Neonatal comfort-holding has also shown benefits for mothers, including decreased maternal post-traumatic stress symptoms and improved maternal attachment.[28,44]

Despite the benefits observed in neonatal and adult populations, comfort-holding has not been widely adopted in critically ill children. In a point prevalence study of early mobilization in 82 PICUs in the United States, Kudchadkar *et al.* found that 51% of children aged less than three years were held, and only 5% of those aged three years and older were held.[45] Similarly, Choong *et al.* found that critically ill children were mobilized out of bed, including comfort-holding, on 36% of patient-days.[46] Given the potential benefit of comfort-holding for critically ill children as an intervention to prevent and manage pain and agitation, and the lack of adoption of this therapy, it is important to evaluate the state of knowledge on the use of comfort-holding in critically ill children. The aim of this study was to understand and summarize the breadth of knowledge on comfort-holding in critically ill children.

Methods

This scoping review was conducted by a multidisciplinary team with expertise in pediatric critical care, epidemiology, and research synthesis. This review was guided by the research question "What is the scope of current literature on comfort-holding in critically ill children?" It was conducted and reported per the Arksey-O'Malley scoping review method.[47] The approach for this review followed the Scoping Review Methods Manual by the Joanna Briggs Institute.[48] The Preferred Reporting Items for Systematic Reviews and Meta-analysis Protocols (PRISMA-P) guideline was used to develop the protocol (Electronic Supplementary Material [ESM], eTable 1).[49] We adhered to the PRISMA-ScR Extension for Scoping Reviews when reporting our findings.[50]

Data sources and searches

A comprehensive search strategy was created through identification of keywords in previous articles, discussion with the research team, consultation with a medical librarian, and use of published search strategies for pediatric studies.[51–54] Searches were conducted in MEDLINE, EMBASE, PsycINFO, CINAHL, and the Cochrane CENTRAL Register of Controlled Trials. Search strategies were revised through a Peer Review of Electronic Search Strategies review.[55] The search strategies combined keywords, synonyms and subject headings from three concepts: 1) child; 2) critical care; and 3) physical touch. The Cochrane Database of Systematic Reviews was searched to identify potential review articles related to the research question and their reference lists were screened to identify additional studies. All databases were searched from inception to 14 April 2020 and no date limits were applied. Only full texts available in English were included. Reference lists of included papers were reviewed to identify additional studies. The complete MEDLINE search strategy is shown in ESM, eTable 2.

Study selection

Inclusion criteria were: 1) quantitative or qualitative primary research studies and 2) studies that reported comfort-holding in a PICU. Studies were excluded if they were not primary research (e.g., literature reviews, editorials), did not report on comfort-holding, or were not conducted in critically ill children (e.g., neonates or adults). For the purposes of this review, we defined: 1) comfort-holding as any non-pharmacologic form of holding, cuddling, skin-to-skin contact, or kangaroo care that allows caregivers to comfort critically ill children through physical touch and is not used as form of immobilization or restraint and 2) critically ill children as any child who is currently admitted to a PICU or had previously been admitted to a PICU. Studies were excluded if only an abstract was available. We utilized a broad definition of caregiver to include family members as well as members of the medical care team.

A pilot-test of title and abstract screening of 50 random studies was completed by a subset of the study team (L.A.L., S.J.M., K.W., B.K.R., D.A.M.). Once 100% agreement was achieved, all titles and abstracts were reviewed independently in duplicate by two reviewers (L.A.L., S.J.M., K.W., B.K.R., D.A.M.) using predetermined inclusion and exclusion criteria (ESM, eTable 3). Any article selected by either reviewer at this stage progressed to full-text review. Full texts of all articles were reviewed independently and in duplicate by two reviewers (L.A.L., S.J.M., K.W., B.K.R., D.A.M.); articles selected by both reviewers were included in the final review. Disagreements were resolved by discussion with a third reviewer (K.F.). References were managed with Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia) and Microsoft Excel.

Data charting

A data extraction tool was developed and piloted by the review team. Two reviewers (L.A.L., S.J.M.) extracted data

independently and in duplicate for each included study and continuously updated the tool to ensure comprehensive data collection of all relevant outcomes for each study in an iterative process. Discrepancies were resolved through discussion between the two reviewers. Information on the type of holding intervention studied, population studied, outcome assessed, and any conclusions reached were extracted.

Data synthesis and analysis

Extracted data were examined and coded based on the context in which holding was studied (end-of-life care, developmental care, holding as an intervention, and mobilization) and the outcome used to assess the holding intervention (frequency of comfort-holding and factors associated with frequency of holding, outcomes for children who received comfort-holding, safety of comfort-holding, and impact of comfort-holding on parental outcomes). Studies were coded blindly and in duplicate by two reviewers (L.A.L., D.A.M.). An alpha value of 0.05 (as reported in each study) was used to determine the statistical significance of the main objective of the study. Qualitative outcomes were summarized and described within each theme.

Results

Of 13,326 citations identified, 13 articles were included in our scoping review (Figure 1). Studies were published between 1989 and 2020 and included nine quantitative analyses,[28,45,56–62] three qualitative analyses,[63–65] and one mixed-methods analysis[66] (ESM, eTable 4). Of the 13 included studies, three had a primary outcome specifically related to comfort-holding[59–61] five assessed comfort-holding as part of end-of-life care,[56,58,63–65] three assessed it as part of generalized developmental care,[28,62,66] and two assessed comfort-holding as part of mobilization.[45,57] Holding was assessed according to four

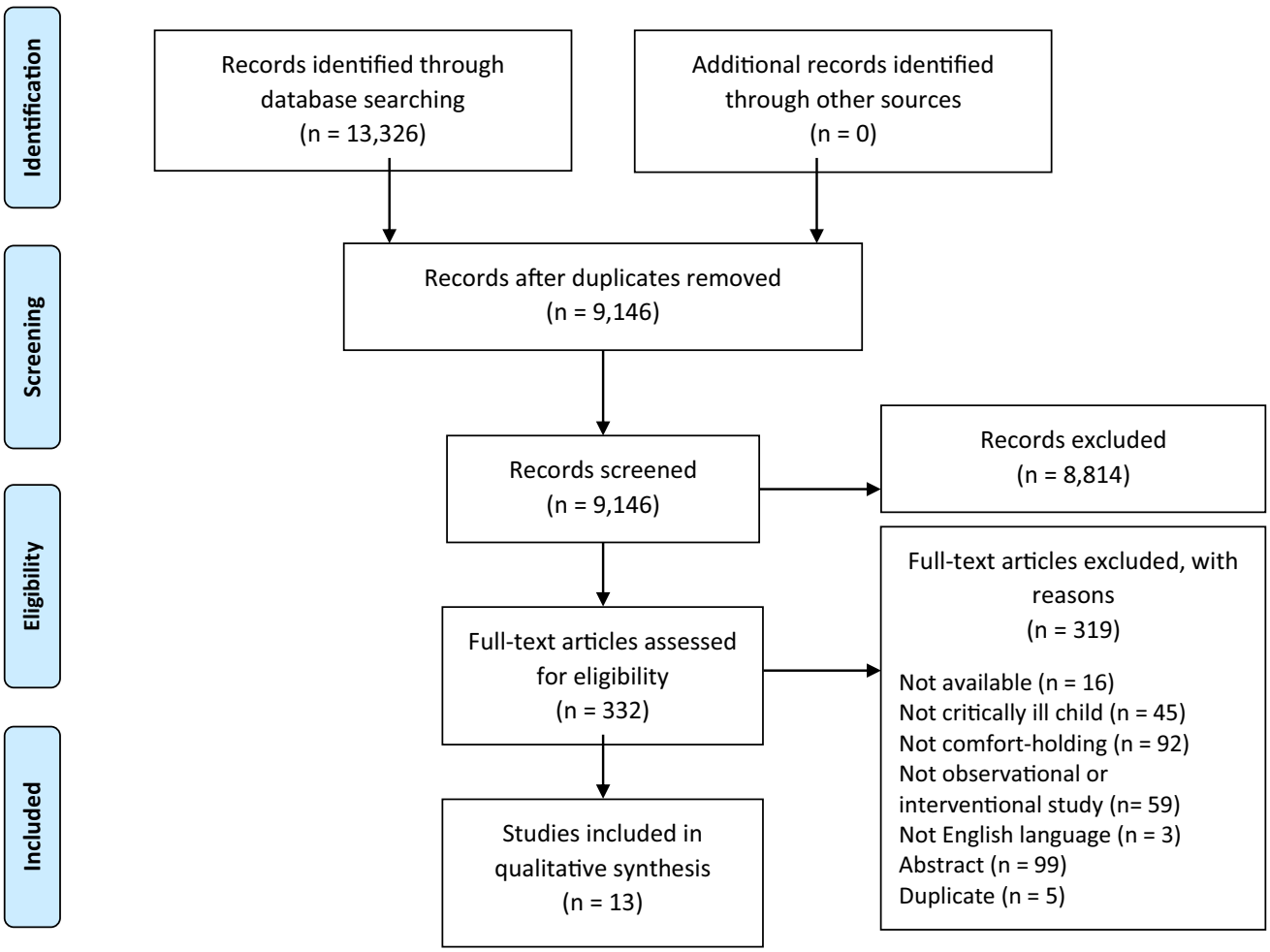

Figure Flow diagram of included studies

Table Thematic categorization of studies

Author	Year of publication	Study location (country)	Type of study	Type of PICU	Participants (*n*)	Single or multicentre	Outcome	Study theme
Gazzolo *et al.*[59]	2000	Italy	Quasi-experimental	PCVICU	5	Single	Child	Holding intervention
Ortman & Dey[61]	2019	USA	Quasi-experimental	Mixed	48	Single	Child/safety/ frequency	Holding intervention
Kudchadkar *et al.*[45]	2020	USA	Cross-sectional observational	PICU, PCVICU & mixed	1695	Multi	Safety/ frequency	Mobilization
Leland *et al.*[60]	2017	USA	Quasi-experimental	PICU	331	Single	Safety/parent	Holding intervention
Sood *et al.*[62]	2016	Canada and United States	Cross-sectional survey	PCVICU	28	Multi	Safety/ Frequency	Developmental care
Beckstrand *et al.*[56]	2010	United States	Cross-sectional survey	PICU	1047	Multi	Parent	End-of-life care
Brooten *et al.*[63]	2019	United States	Qualitative analysis	NICU & PICU	81	Multi	Parent	End-of-life care
Colwell *et al.*[57]	2019	United States	Cross-sectional observational	PICU	120	Single	Parent	Mobilization
Falkenburg *et al.*[65]	2016	Netherlands	Qualitative thematic analysis	PICU	20	Single	Parent	End-of-life care
McGraw *et al.*[64]	2012	United States	Qualitative; thematic analysis	PICU	18	Multi	Parent	End-of-life care
Snowdon & Gottlieb[66]	1989	Canada	Mixed-methods	PICU & ward	12	Single	Parent	Developmental care
Garros *et al.*[58]	2003	Canada	Retrospective cohort study	Mixed	99	Single	Frequency	End-of-life care
Klug *et al.*[28]	2020	United States	Quality improvement	PCVICU	126	Single	Frequency	Developmental care

In the Outcome column, "child" denotes outcomes for children who receive comfort-holding; "safety" denotes safety of comfort-holding; "frequency" denotes the frequency of comfort-holding and factors associated with the frequency of comfort-holding; and "parent" denotes the impact of comfort-holding on parent outcomes

NICU = neonatal intensive care unit; PCVICU = pediatric cardiovascular intensive care unit; PICU = pediatric intensive care unit

outcomes: 1) the frequency of holding and factors associated with frequency of holding (five studies),[28,45,58,61,62] 2) outcomes for children who received comfort-holding (two studies)[59,61] 3) the safety of comfort-holding (three studies),[45,60,62] and 4) the impact of comfort-holding on parental outcomes (seven studies)[56,57,60,63–66] (Table).

Outcomes of comfort-holding

Frequency of holding

Frequency of comfort-holding and factors associated with comfort-holding were assessed in five studies.[28,45,58,61,62] Comfort-holding was more common in infants and young children (i.e., children younger than three years) and at the end of life.[45,58,62] When family members were present, Garros *et al.* found that 77.8% of children were held at the end of life.[58] In a survey of 28 cardiac PICUs in North America by Sood *et al.*, 57% of units stated they encouraged skin-to-skin or kangaroo care and 46% had formal comfort-holding policies for infants.[62] A point prevalence study of mobility by Kudchadkar *et al.* found that 51% of children less than three years old were held, whereas less than 5% of children three years or older were held.[45]

Following implementation of a structured comfort-holding intervention, Ortman and Dey reported that 64% of critically ill infants underwent two episodes of comfort-holding per day.[61] However, in a quality improvement program to increase partnerships in developmental care of infants, which included use of a communication tool to improve awareness of readiness to hold, Klug *et al.* found a significant decrease in partnership activities after their

intervention.[28] These partnerships were presented as a pyramid of advancing levels of care that parents could participate in. Children advanced to higher levels of parent participation as their severity of illness decreased. Despite the goal of improving parental engagement, the number of shifts on which care partnerships (including comfort-holding) occurred decreased from 15% to 10% between 12 and 18 months following initiation of the intervention.[28]

Factors associated with comfort-holding were reported in two studies.[45,62] In their cross-sectional survey, Sood *et al.* found that most cardiac PICUs reported infant holding with chest tubes (86%), arterial lines (68%), intubation (61%), and external pacing (53%).[62] Few cardiac PICUs reported that they allowed holding with intracardiac lines (18%), critical airways (18%) and extracorporeal membrane oxygenation (14%). In the point prevalence study by Kudchadkar *et al.*, presence of an endotracheal tube, opioid infusion, and severe developmental disability were associated with less out-of-bed mobilization, which included comfort-holding.[45] The same study also found a positive association between increased out-of-bed mobility and the following variables: PICU length of stay, lower nurse-to-patient ratio, and family presence for children less than three years of age. The most common barrier they identified for out-of-bed mobility was cardiovascular instability and over sedation.[45]

Child outcomes

Both Gazzalo *et al.* and Ortman and Dey assessed outcomes for children in relation to comfort-holding.[59,61] In a study of the use of kangaroo care immediately following extubation for five infants aged zero to five months, who had previously undergone cardiac surgery, Gazzalo *et al.* found a significant improvement in cardiorespiratory parameters including oxygen saturation, transcutaneous carbon dioxide, and heart rate.[59] In a pre-and-post analysis of a comfort-holding intervention for 48 infants intubated for respiratory failure, Ortman and Dey found no difference between groups in duration of intubation, PICU length of stay, or hospital length of stay.[61] As a surrogate measure of comfort, Ortman and Dey studied total analgesic and sedative use and found a significant increase in the number of dexmedetomidine infusions and median total PICU dose of fentanyl, and a decrease in the median total midazolam dose in the intervention group. They attributed this to a change in practice, not to their holding intervention.[61]

Safety outcomes

The safety of comfort-holding was assessed in three studies.[45,60,62] In a survey of cardiac PICUs, 39% of 28 units reported having at least one adverse event (e.g., tube or line dislodgements) related to infant comfort-holding.[62] However, two small, single-centre pre-post studies found no difference in adverse events (e.g., unplanned extubation and/or accidental line removal) after initiation of comfort-holding.[60,61] A point prevalence study of mobility (including comfort-holding) in 1,695 children of any age admitted to 82 PICUs found the rate of safety event occurrence (e.g., transient change in vital signs, loss of invasive devices, and falls) was 4% for 4,700 mobility sessions[45] The most commonly reported safety event was transient vital sign changes, which occurred in 3% of mobility events. Severe events per mobilization event were as follows: endotracheal tube dislodgement 0.15%, tracheostomy dislodgement 0.1%, arterial line dislodgement 0.2%, and chest tube dislodgement 0.7%.[45]

Parental outcomes

Of the 13 studies included in our review, seven evaluated the impact of comfort-holding on parental outcomes.[56,57,60,63–66] In a mixed-methods, prospective observational and qualitative study, Snowdon and Gottlieb identified that one of the important roles of a parent whose child is admitted to hospital (both PICU and pediatric ward) was that of "nurturer-comforter," and the most frequently observed behaviour in this role was touch.[66] They noted that, because parents were not allowed to hold their children in the PICU like they could in the ward, they would instead stroke and caress their children. The impact of holding on parents was examined as part of end-of-life care in four studies.[56,63–65] Holding was found to be both positive and important for parents.[56] Parents placed a great deal of value on the opportunity to be physically close to their child. Physical intimacy was felt to be a necessity.[65] When unable to hold, parents, especially those of adolescents, felt great value in lying next to their children in bed.[65] Touch and holding were viewed as important in establishing a connection with their child and inability to hold decreased this connection.[64,65] When asked open-ended questions about what they wished they had or had not done, Brooten *et al.* found that 9–11% of mothers and 0% of fathers whose children died in PICU wished they had held their children more around the time of death.[63]

Two studies examined the effect of interventions to increase comfort-holding outside of end-of-life care.[57,60] In a pre-post study, Leland *et al.* found that parents perceived a significantly greater sense of being valued as a member of the care team and had significantly higher well-being scores following an initiative promoting physical contact between caregivers and children in a PICU.[60] In a cross-sectional chart review and survey of the effect of mobilization on parental stress in the PICU, Colwell *et al.* included comfort-holding as a mobilization activity.[57] They found that 81% of parents found mobilization not

very stressful or not stressful at all.[57] The type of mobilization (e.g., comfort-holding, ambulation, sitting in a chair) was not associated with different levels of self-reported parental stress.[57] Parents identified that medical equipment, subjective pain, and perceived dyspnea increased stress with mobilization, while clinical improvement, parental participation, and increased alertness of their child were perceived as positive aspects of mobilization.[57]

In all but one study assessing parental outcomes,[65] female parents (77–100%) were disproportionately over-represented compared with male parents (0–22%).[57,59,60,63,64,66]

Discussion

This scoping review of 13 articles provides an overview of the literature related to comfort-holding in critically ill children. This review identified outcomes related to comfort-holding and identified gaps in the literature. The literature assessing outcomes for children (as opposed to parents) is scarce, with a single study of only five infants finding an improvement in cardiorespiratory parameters, and a single study of 48 infants finding no difference in duration of intubation or length of stay.[59,61] Adverse events associated with mobilization events (including comfort-holding) are infrequent (0–3%).[45,61] Parents appear to benefit from, and place importance on, comfort-holding both at the end of life and during acute management.[56,57,60,63,64,66,67] Comfort-holding is common at end of life.[58] Nevertheless, it is less frequent in acutely ill infants and children, and rare in children older than three years.[28,61] Despite the breadth of studies identified, there is a paucity of literature on comfort-holding and we identified several gaps in the existing literature on comfort-holding in children.

Only two small single-centre studies have examined outcomes for children who receive comfort-holding. Although Ortman and Dey measured the use of analgesic and sedative infusions as a surrogate for comfort, neither study assessed any objective markers of pain or agitation for the infants who received comfort-holding.[59,61] Both studies only included infants less than six months of age. Thus, there was no literature at the time of our review examining the effect of comfort-holding on children older than six months of age. Further studies assessing comfort-holding and its effect on both cardiorespiratory parameters, ventilator days, length of stay, pain and agitation scoring, and use of analgesics and sedatives are needed in all ages of children admitted to the PICU to determine whether this intervention is beneficial to children.

The majority of research on comfort-holding is related to parental outcomes, with all studies showing either importance or positive effect for parents.[56,57,60,63,64,66,67] Female parents were disproportionately more represented than male parents in all but one study. Further, Brooten *et al*. found that mothers reported a desire to hold their children more, but fathers did not.[63] There were significantly more mothers (n = 81) than fathers (n = 23) in their study making it unclear if the results were generalizable; however, it may signal that women perceive holding differently than men do and thus may be impacted differently by this intervention. Future research should ensure an equal representation of all genders of parents in studying comfort-holding.

Safety was assessed in only three studies. Both interventional trials found no increase in adverse events with comfort-holding; however, these were very small sample sizes of infants (five and 24 subjects, respectively).[59,61] Kudchadkar *et al.* also reported very low adverse events for mobilization, which included comfort-holding, in 1,600 children across the United States.[45] This data may be generalizable to other PICU settings with similar demographic profiles in developed nations because of its large sample size and multicentre cohort. Nevertheless, given that the data were not reported specifically for comfort-holding it is unclear if safety rates are higher or lower for comfort-holding than other mobilization activities. Thus, research that is specific to comfort-holding in larger samples of all ages is needed to determine the safety of this intervention.

The rates of comfort-holding, though determined in studies related to early mobilization, appear to be low and given the study by Klug *et al*., where comfort-holding decreased in opposition to the goal of their program, more research is needed to understand facilitators and barriers to comfort-holding in critically ill children.

This scoping review has several strengths. This review was conducted by a team with expertise in pediatric critical care and scoping review methodology. We employed a systematic approach with multiple reviewers and a priori defined methodology. We employed strict inclusion criteria that were necessarily broad to capture comprehensive extant literature. This review has limitations: we did not search grey literature and we excluded three studies that were not available in English, which may have led to exclusion of potentially relevant studies.

Conclusion

There is a paucity of literature on comfort-holding in critically ill children. This scoping review highlights outcomes to consider in future evaluations of this intervention including child outcomes, parent outcomes, and safety of the intervention. Future directions include

exploratory research to understand barriers to comfort-holding in older children, and ultimately clinical trials of comfort-holding in children of all ages assessing safety, objective measures of comfort, and physiologic effects on children and all genders of parents.

Author contributions LAL contributed to all aspects of this manuscript, including study conception and design; acquisition, analysis and interpretation of data; and drafting and editing of the manuscript. SJM contributed to study conception and design, search strategy development, screening and inclusion of papers, data extraction, and drafting and editing of the manuscript. DAM contributed to study conception and design, screening and inclusion of papers, and thematic analysis and editing of the manuscript. BKR and KW contributed to study conception and design, search strategy development, screening and inclusion of papers, and editing of the manuscript. EG contributed to study conception and design and manuscript editing. KMF provided oversight and expertise on all aspects of this manuscript including study conception and design, acquisition, analysis and interpretation of data, and editing of the manuscript.

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