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Family-centered care in neonatal and pediatric critical care units: a scoping review of interventions, barriers, and facilitators

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Abstract

Introduction The Family-Centered Care (FCC) model has been linked to improved clinical outcomes and family satisfaction. However, implementing this model can be challenging, especially in neonatal and pediatric critical care units. This review aims to map the literature on FCC in neonatal and pediatric critical care units, identify barriers and facilitators of effective interventions, and suggest a practical step-by-step approach for implementing FCC interventions.

Methods This scoping review was guided by the PRISMA-ScR guidelines and followed the Arksey and O'Malley 5-step scoping review framework. We accessed the databases on the 28 th of April, 2024, and included all prospective and randomized controlled trials (RCT) implementing FCC interventions from PubMed and Web of Science databases. Data were organized, tabulated, and described narratively.

Results Out of 1,577 potentially relevant citations after duplicate removal, 17 articles met our eligibility criteria (4 RCTs and 13 prospective studies). Nine of these studies were conducted in neonatal intensive care units (NICU) and eight in pediatric intensive care units (PICU). Three NICU interventions were single-type interventions, while six were part of comprehensive programs; in the PICU, seven were single-type interventions and one was part of a comprehensive program. All interventions incorporated elements of FCC principles (respect, information sharing, collaboration, and participation). Barriers included institutional factors, provider attitudes, cultural issues, communication challenges, environmental constraints, training needs, and emotional stress. FCC facilitators included enhanced environment, empowerment and training, supportive Infrastructure, collaborative communication, parental Involvement, adaptive interventions, and continuous feedback.

Conclusion Effective implementation of FCC interventions requires careful planning and needs assessment. It ensures management support, regular staff training, family orientation, and a continuous feedback loop. Incorporating FCC principles and delivering culturally acceptable interventions is key while acknowledging possible barriers and utilizing available facilitators. FCC interventions can help foster a healthcare culture that values partnerships with families and can transform the neonatal and pediatric critical care experience for patients, families, and providers alike.

Keywords Family-centered care, Picu, Nicu, Intervention, Barrier, Facilitator

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Introduction

The Family-Centered Care (FCC) model is a comprehensive approach that highlights collaboration among medical professionals, patients, and families to address the emotional, social, and developmental needs of pediatric patients and individuals with serious or chronic illnesses [1]. By incorporating family preferences and promoting shared decision-making, FCC aims to enhance health outcomes for both patients and their families [2]. FCC is built on four core principles: Respect & Dignity, Information Sharing, Participation, and Collaboration [3]. These principles ensure that families are active partners in pediatric care, leading to improved patient and family outcomes.

Applying these principles has led to significant advancements in pediatric healthcare. Research shows that FCC enhances the emotional resilience of children and their families [4], reduces health care utilization [5], enhances satisfaction, and increases quality of life [6]. It has also been associated with lower parental stress and greater caregiver confidence in managing their child's illness [7, 8]. By actively involving families in the care process, FCC helps create a supportive environment that fosters open communication, strengthens the family-provider relationship, and promotes shared decision-making, all of which contribute to improved psychological well-being and parental satisfaction during a child's hospitalization [6].

Furthermore, family involvement in intensive care units (ICUs) has been linked to improved emotional health for children and stronger family cohesion, as noted by Aija et al. [9]. Such involvement enhances adherence to long-term rehabilitation programs and may lower readmission rates, highlighting its role in promoting high-quality care during recovery. Despite its benefits, implementing FCC faces challenges, including lingering paternalistic practices, where healthcare providers make decisions on behalf of families with minimal or no input from them [10], that limit family engagement, resource constraints, and the absence of standardized protocols. Sociocultural factors further complicate implementation. For example, in some regions, cultural customs may restrict caregiving roles for certain family members, while visitation restrictions in ICUs limit family presence and bonding [11].

This scoping review aims to identify and describe methods for implementing FCC in neonatal and pediatric critical care units. It also highlights common barriers and facilitators related to these interventions. To explore this complex landscape, the identified interventions are organized into categories based on whether they were implemented in pediatric or neonatal intensive care units and whether they were single interventions or part of comprehensive programs. A key aspect of this effort is assessing effectiveness and helping to adapt these interventional methods into practice. Ultimately, this project aims to provide practical recommendations with clear, actionable steps that represent best practices for implementing FCC in neonatal and pediatric critical care units, ensuring that families remain at the heart of the healing process.

Methods

Study design

Due to the broad aim of this review, the graded nature of its objectives, and the likelihood of significant heterogeneity in the interventional methods used to deliver FCC and assess effectiveness, a scoping review methodology was deemed the most appropriate synthesis methodology. FCC was defined based on the four core principles of Respect & Dignity, Information Sharing, Participation, and Collaboration [3], which guided the study selection. A scoping review methodology was followed, based on the Arksey and O'Malley 5-step framework [12], allowing for a thorough evaluation of the literature through a stepwise approach. The steps of this framework include (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) charting data, and (5) collating, summarizing, and reporting results. Our methods were reported in accordance with the PRISMA-ScR checklist [13].

Research question

Following the PCC (population, concept, context) model for research questions [14], this scoping review's research question was identified as follows:"What interventional methods do pediatric healthcare professionals use to implement family-centered care in neonatal and pediatric critical care units?".

Population: Pediatric healthcare professionals.
Concept: Interventional methods of family-centered care practices
Context: Neonatal and pediatric critical care units

Search strategy

The search was performed in two databases by H.A. (PubMed and Web of Science) on April 28, 2024, using the following search terms: family-centered care, pediatrics, implementation, methods, quality improvement, and audit, combined with Boolean operators and a database-specific search strategy (Table 1). The search was not limited to geographic location or time but was limited to the English language. We conducted our search on April 28, 2024, and the earliest publication we identified was from 1963.

Table 1 Data sources

Database	*Search strategy*	*No. of retrieved citations*
PubMed	(((family-centered care[Title/Abstract]) OR (family-focused care[Title/Abstract])) OR (Patient-centered care[Title/Abstract])) AND ((pediatric[Title/Abstract]) OR (children[Title/Abstract])) AND ((quality improvement[Title/Abstract]) OR (implementation[Title/Abstract]) OR (audit[Title/Abstract]) OR (method*[Title/Abstract]) OR (strategy[Title/Abstract]) OR (strategies[Title/Abstract]))	1,004
Web of Science	("family-centered care") OR ("family-focused care") OR ("Patient-centered care") AND ((pediatric) OR (children)) AND (("quality improvement") OR (implementation) OR (audit) OR (method) OR (strategy) OR (strategies))	1,367

Eligibility

Studies were eligible for inclusion if they were (1) prospective or randomized interventional studies addressing FCC as an outcome measure in neonatal and pediatric critical care units, (2) pediatric patients (under the age of 18), their caregivers, families, or healthcare providers as participants, (3) articles describing interventions for implementing FCC by healthcare professionals, and (4) full-text articles available for assessment. To align with the scoping review's aim of focusing on FCC interventions, as well as their barriers and facilitators in neonatal and pediatric critical care units, studies were excluded if they did not present a clear and specific intervention to implement FCC or if they solely assessed healthcare professionals'perceptions of FCC. Including clinician perspectives without an actual intervention would divert the focus from identifying practical, tested strategies with real-world applicability.

Study selection and screening process

Search results were exported from the databases to Rayyan, where duplicates were removed, and articles were selected for inclusion. Two independent researchers (F.A. and H.A.) performed the title and abstract screening, followed by full-text screening, and disagreements were resolved based on consensus using Rayyan [15]. The selected articles were also examined in relation to the four FCC principles (respect and dignity, information sharing, participation, and collaboration) to explore their alignment.

Data extraction

We used a standardized Excel form for data extraction in an iterative process, which was conducted by two independent investigators (B.A. and H.A.), followed by each reviewing the data extracted by the other. We piloted the form for the first five manuscripts and revised it accordingly. The final form included the author's name, year of publication, country, study design, study duration, FCC assessment method, setting (PICU/NICU), inclusion/exclusion criteria, pediatric illness, number of participants, details about the interventional method, designated healthcare providers carrying out the intervention, the article's key findings, barriers to and facilitators of FCC, and reporting on gaining ethical approval for the study.

Data synthesis

The literature mapping around FCC interventions in neonatal and pediatric critical care units, their barriers, and facilitators was described and tabulated using descriptive methods. Qualitative data were categorized and analyzed according to the setting (PICU vs. NICU) and nature of intervention (single vs. comprehensive program). A narrative description and analysis are presented per the PRISMA-ScR checklist. A thematic analysis of the barriers to and facilitators for FCC interventions was conducted using an inductive approach [16].

FCC interventions were further synthesized into thematic categories based on recurring patterns in their design and implementation. Single interventions were classified into five main themes: Enhanced Communication and Information Sharing, Empowering Parental Participation, Structured Family-Centered Rounds, Physical Environmental Changes, and Targeted Education and Support. These categories emerged through inductive thematic analysis rather than a predefined framework [16]. Meanwhile, comprehensive program-based interventions were analyzed separately due to their broader scope and structured implementation strategies.

Based on the analysis of common patterns across the identified interventions, their procedures, and facilitators, we developed a step-by-step model to guide the successful implementation of FCC in neonatal and pediatric critical care units. The discussion section provides further details about the model.

Results

Search and selection of relevant studies

The original search was conducted on the 28 th of April 2024, yielding 2,372 potentially relevant citations. After deduplication and relevance screening, 267 citations met the initial eligibility criteria based on title and abstract screening. Fourteen citations were excluded as full-text articles could not be retrieved after contacting primary authors via email with no response, and the full-text article screening yielded 17 citations that met the eligibility criteria and were included in the final review. One of the studies included was identified from the references of another article during the screening process. The flow of articles through identification to final inclusion is represented in Fig. 1 [17].

General description of the studies identified

All included articles were published between 2013 and 2023, with 70% (12 out of 17) published after 2019. Two articles did not report the duration of the study. For the remaining 15 studies (out of 17) that did report, the average duration was approximately 14.2 months, ranging from 1 to 46 months. The number of articles included in the review from NICU and PICU settings is nearly equal, with 52.9% (9 out of 17) from NICU [18–26] (Table 2) and 47.1% (8 out of 17) from PICU [27–34](Table 3).

The studies included in this review were conducted across 13 countries, showcasing a diverse geographic scope for FCC in neonatal and pediatric critical care. Most of the studies came from high-income countries, with 8 of the 17 studies (47%) from North America

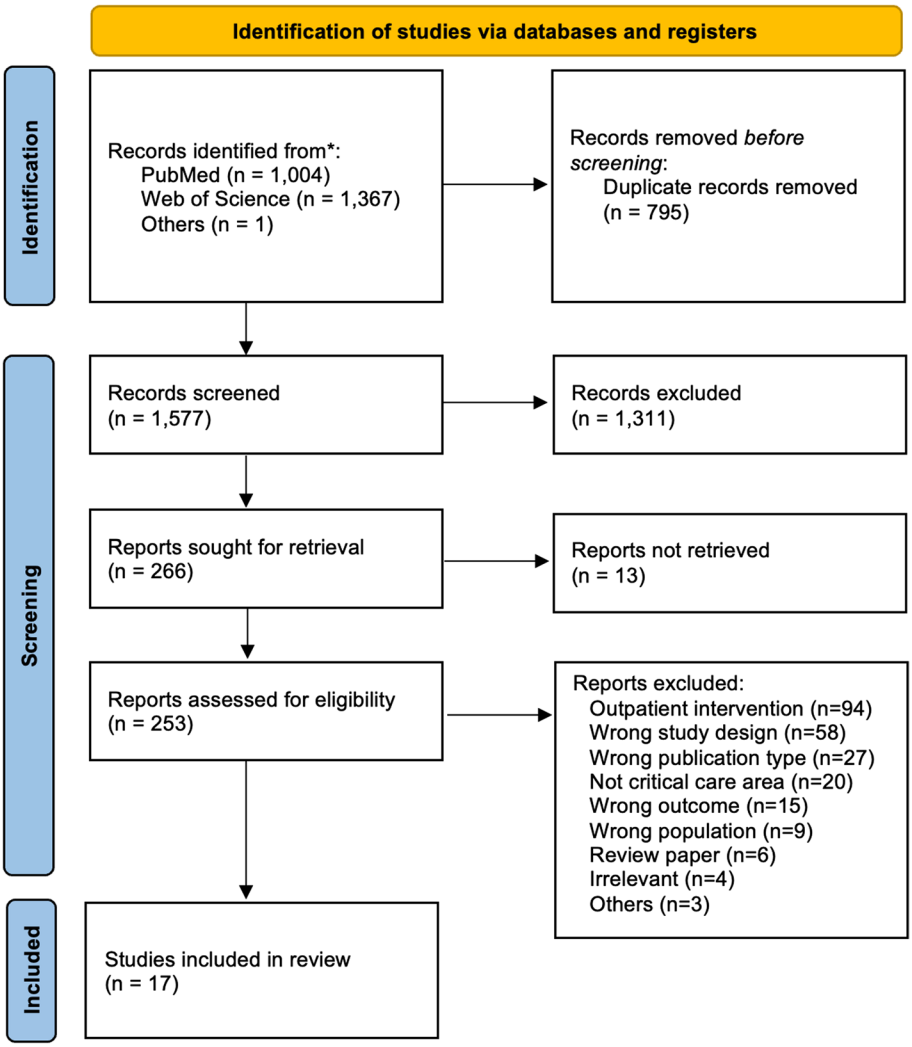

Fig. 1 PRISMA flowchart of the study selection process (ref: Page MJ, et al. BMJ 2021;372:n71. https://doi.org/10.1136/bmj.n71.)

Table 2 Synthesis of the studies included in the review of FCC interventions performed in the NICU ($n = 9$)

Author, year		Country	Aim	Design	Duration	Sample	Intervention
Single type intervention	Epstein, 2015	United States	Evaluate the feasibility of daily Skype or FaceTime updates with parents to assess the intervention's potential for improving parent-provider relationships	Pre/post mixed-methods approach	not mentioned	26 parents of 25 infants, with 15 parents completing the study	Daily Skype or FaceTime updates for parents
	Feeley, 2020	Canada	Compare NICU stress, symptoms of depression, perceptions of nurse-parent support and FCC, sleep disturbances, breastfeeding self-efficacy, and readiness for discharge in mothers of infants cared for in an OW to those cared for in a unit that includes both pods and SFR	Pre-post quasi-experimental study	1 year	150 Mother-infant dyad: Open Ward ($N = 70$) and Pod-SFR Units ($N = 80$)	Transitioning from an open ward (OW) to a combined pod and single-family room (SFR) design
	Rosenthal, 2021	United States	Measure the feasibility, reach, and potential impact of virtual family-centered rounds	Randomized controlled pilot trial	6 months	110 caregivers: 74 intervention and 36 control	Virtual family-centered rounds
Program-based intervention	He, 2018	China	Evaluate the impact of a Family Integrated Care (FIC) intervention on the clinical outcomes of preterm infants with BPD	Pre-post intervention study	9 month	249 infants: 134 pre-intervention group 115 post-intervention group	Integrate family care program to improve the clinical outcomes by involving parents directly in the care of their infants
	Maria, 2021	India	Examine the feasibility and acceptability of the FCC model	Prospective cohort design	12 months	333 parent-attendant/infant dyads 24 doctors, and 21 nurses	FCC parent participation program
	Toivonen, 2021	Finland	Evaluate the effects of the Close Collaboration with Parents intervention on the quality of FCC	Quasi-experimental study without a control group	46 months (2 years in each NICU)	139 nurses and 116 families: 54 families pre-intervention 62 families post-intervention	Close Collaboration with Parents training program
	Albayrak, 2022	Turkey	Improve nurses' attitudes towards parental engagement and to examine the impact of implementing nursing interventions related to FCC on neonatal and parental outcomes	Quasi-experimental, nonequivalent, and post-test research	12 months	128 participants: 64 experimental group 64 control group	Implementing family-centered nursing care interventions
	O'Brien, 2019	Canada Australia New Zealand	Analyze the effect of Family Integrated Care (FICare) on infant and parent outcomes, safety, and resource use	Multicenter, multinational, cluster-randomized controlled trial	34 months	26 NICUs with a total of 1,786 infants: 895 FICare group 891 standard care group	Implementing the Family Integrated Care (FICare) program
	Heo, 2019	South Korea	Develop a Parent Participation Improvement Program for parents and evaluate its effects on parents'partnerships with nurses, attachment to infants, and infants'body weight	Randomized controlled trial	6 months	66 infants and 132 parents (62 mother-father dyads)	Promote parent participation through a Parent Participation Improvement Program

Table 3 Synthesis of the studies included in the review of FCC interventions performed in the PICU ($n = 8$)

Author, year		Country	Aim	Design	DURATION	Sample	Intervention
Single type intervention	Ladak, 2013	Pakistan	Assess whether family-centered rounds improve parents'and health care professionals'satisfaction, decrease patient length of stay, and improve time utilization when compared to traditional practice rounds	Non-randomized before-after study design	4 months (2 pre- and 2 post-intervention)	82 parents: 41 parents per group	Family-centered rounds
	Levin, 2015	United States	Identify areas for improvement in family-centered rounds from both the family and provider perspectives	Prospective, cross-sectional mixed-methods study	10 weeks	232 FCR encounters representing 176 unique patients and 92 unique parents	Family-centered care rounds
	Spazzap, 2019	United Kingdom	Assess whether the introduction of personalized bedside boards containing nonmedical information about patients could help provide HCP better insight about each child's personal qualities and preferences	Pre- and post-intervention assessment	1 month	38 respondents at baseline 36 after the intervention (Parents and HCP)	Personalized bedside boards containing nonmedical information about patients
	Chamblee, 2021	United States	Determine if an FCC handout intervention could enhance family engagement in preventing CLABSIs and subsequently improve parental perceptions of FCC and increase staff compliance with CLABSI bundle	Prospective quasi-experimental study	10 months	121 parents: 59 baseline group 62 intervention group	FCC handout to educate parents on CLABSI prevention strategies and encourage participation in CVC care
	Gawronski, 2023	Italy	Describe the feasibility, utilization, and perceptions of parents and healthcare providers regarding PICU diaries	Prospective, observational study	10 months	20 families, with a total of 275 daily PICU diary entries collected	PICU diaries to enhance communication and support between HCP and parents
	Edwards, 2023	United States	Investigate the advantages and disadvantages of primary continuity intensivists and nurses for long-stay patients	Prospective cross-sectional mixed-methods study	2 years	120 families: 64 families control group, 56 families intervention group	Primary continuity intensivists and nurses for long-stay patients
	Khaksar, 2022	Iran	Investigate the role and participation of fathers in the sleep of hospitalized children with pneumonia during the COVID- 19 pandemic	Intervention, control, pre-test and post-test groups	not mentioned	40 children: 20 in intervention 20 as control	Involve fathers in the care of their hospitalized children to improve sleep outcomes

Table 3 (continued)

Author, year		Country	Aim	Design	DURATION	Sample	Intervention
Program-based intervention	Leland, 2017	United States	Evaluate an initiative promoting physical contact between caregiver and patient in improving caregiver spiritual wellbeing	Prospective, pre-post interventional study	14 months	331 caregivers: 174 pre-ROSE group 157 post-ROSE group	Project ROSE (Reach Out, Soothe, and Embrace): Improve physical contact between caregivers and hospitalized children through a practice change initiative

(Canada and the United States) and Oceania (Australia and New Zealand), and 3 studies (17.6%) from Europe (the United Kingdom, Italy, and Finland). Asian countries, including China, South Korea, Turkey, Iran, Pakistan, and India, accounted for 6 studies (35.2%). Thirteen studies were prospective, while four were randomized controlled trials (RCTs), including one multinational RCT involving Canada, Australia, and New Zealand. Less than half of the studies (7 out of 17) reported the use of a validated FCC measurement tool.

There was significant variation in sample sizes across studies. When classifying these sizes based on the number of infants and children involved, small cohorts with fewer than 50 participants accounted for 23.5% (4 out of 17) [18, 29, 31, 33], medium cohorts with 50 to 150 participants made up 47% (8 out of 17) [19, 20, 23, 24, 26, 27, 30, 32], and large cohorts with more than 150 participants represented 23.5% (4 out of 17) [21, 22, 28, 34]. Only one study included more than 500 participants, and that was the multinational and multicenter study [25].

FCC interventions in neonatal and pediatric critical care areas

We have identified various FCC interventions aimed at enhancing family involvement in neonatal and pediatric critical care units (Table S.1). These interventions can be categorized as either single or program-based, addressing at least one of the FCC principles [3]. Program-based interventions provide a more holistic approach to FCC with overlapping themes, while single interventions were classified into five main categories.

Single type interventions

Enhanced communication and information sharing

This category focuses on interventions that aim at promoting clear, effective, and timely communication between healthcare providers and families. An example is using daily Skype or FaceTime updates for parents [18] to provide consistent and transparent communication. Another instance includes the use of PICU diaries [31] or personalized bedside boards that contain non-medical information about patients [29], which enhance communication and support between healthcare providers and parents while offering emotional insight. This is also seen in the intervention of primary continuity intensivists and nurses for long-stay patients [32].

Empowering parental participation

This intervention category aims to equip parents with the necessary skills to participate actively in their child's care. It provides support and guidance to enable meaningful parental involvement. All four FCC principles are demonstrated through this category, which is exemplified by the intervention of involving fathers in the care of their hospitalized children to improve sleep outcomes [33].

Structured family-centered rounds

This category describes the introduction of family-centered rounds [27, 28] to formally and systematically involve families, ensuring that parents are present and actively engaged in discussions about their child's care. A unique and innovative approach to conducting these rounds was the use of virtual platforms [20], allowing remote participation from families who cannot commute and participate physically. All four FCC principles are demonstrated through this category.

Targeted education and support

These interventions focus on providing targeted and specific education or support to parents, enhancing their understanding of their child's condition, treatment, and care needs. The use of an FCC handout to educate parents on CLABSI prevention strategies and encourage participation in CVC care illustrates this approach [30].

Physical environmental changes

This category includes interventions aimed at transforming the physical structure of the critical care unit to create a welcoming and private environment for families during challenging and emotional times. An example of this is the transition from an open ward to combined pods and single-family room design [19].

Program-based interventions

All program-based FCC interventions were preceded by dedicated training of healthcare professional, and some had regular retraining sessions [22]. One intervention had an FCC committee to ensure ample support for its success [24]. They were characterized by their systemic approach to integrating FCC principles across all aspects of care delivery. This underscores the importance of careful planning and training healthcare professionals to commit to the initiative's success. Many of the interventions required interprofessional collaboration among healthcare professionals from different backgrounds [20, 22, 23, 25, 27, 29, 31, 34], but all required nurses'participation, reflecting nurses'major role in the FCC dynamics (Table S.1).

In addition to educating healthcare professionals, interventions could involve targeted parental education to empower parents in taking an active role in their child's care [21–26, 30, 33, 34]. Policy changes could also create a more friendly FCC environment, such as extending visitation hours [24]. Furthermore, psychological or peer support can assist parents in navigating the challenges associated with their child's critical condition illness [25].

The Family Integrated Care (FICare) program exemplifies a holistic approach to FCC with dedicated training workshops for participating study sites, a parent education program, specialized nursing training, and the provision of a psychosocial support program through peer support and social workers [25]. This program was associated with significant objective improvement in infant weight gain, breastfeeding rates, and parental stress and anxiety levels.

On the other hand, the Parent Participation Improvement Program had a more focused scope by delivering the FCC intervention through three stages [26]. Parents would identify their personal challenges and set personal goals in improving parent-nurse interaction, followed by an introduction to the NICU environment and learning various baby cues. Parents would then actively participate in delivering nursing care, such as changing diapers, breastfeeding, soothing, kangaroo care, bathing, dressing, developmental positioning, singing, and talking. This intervention showed significantly higher scores in partnership and attachment, albeit no significant difference in infants' weight between the intervention and control groups.

Barriers to FCC

The interventional methods had several barriers that hindered the implementation of FCC in neonatal and pediatric critical care units (Fig. 2). These challenges occurred at institutional, provider, family, and environmental levels, underscoring the importance of understanding how they affect targeted improvements. We have categorized the main barriers identified from these studies below:

Institutional and resource barriers

Institutional Support and Policy Challenges: Institutional support was felt to be lacking in some interventions due to competing priorities, other than FCC, to optimize workflow and clinical outcomes. One of the studies on family-centered rounds reported this and stressed the importance of securing institutional support and implementing policy changes to drive the FCC forward, which can be challenging [27].

Resource Constraints: In the study that evaluated providing daily virtual updates for parents in the NICU [18], despite the positive results reported, the authors acknowledge that providing FCC using digital means may be challenging in resource-poor settings, especially in lower-income areas. Healthcare leadership may redirect financial support to other services that could have a broader impact on the community health.

Environmental and Workload Factors: Several studies have highlighted that healthcare settings are inherently high-stress environments, particularly neonatal and pediatric critical care units. The combination of heavy

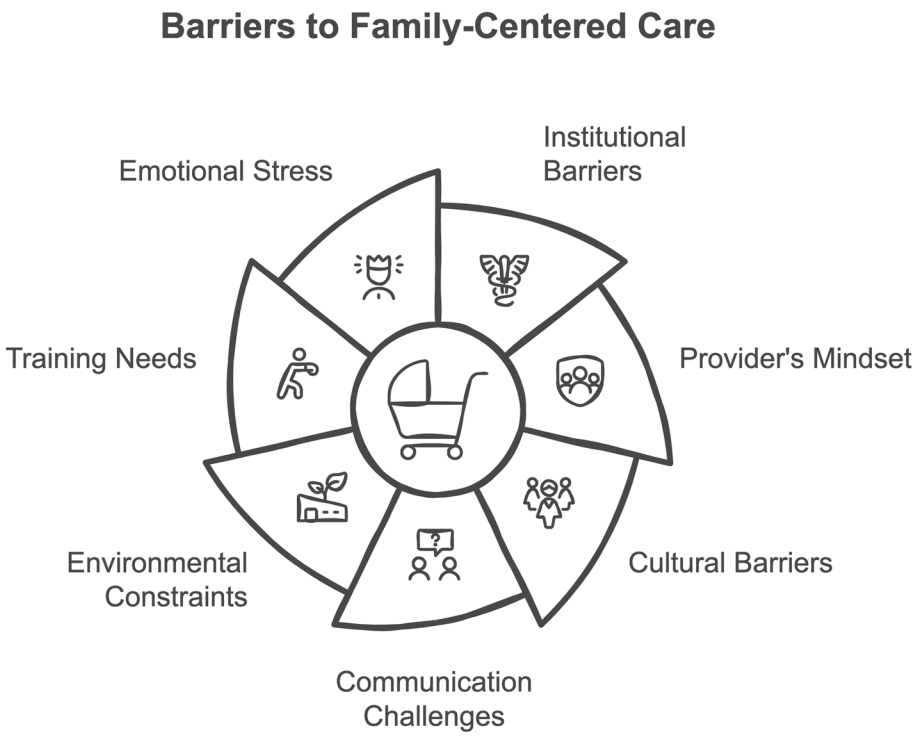

Fig. 2 Identified barriers to family-centered care

workloads, a limited workforce, and insufficient training opportunities for engaging healthcare providers in FCC created a significant barrier to delivering FCC effectively [24, 27, 29].

Provider attitudes and mindset

Traditional Provider-Centered Attitudes: Two studies around family-centered rounds described how the paternalism model approach in provider-centric care is deeply rooted in healthcare [27, 28]. They reported challenges in transitioning to FCC, especially in an environment where providers adhere to task-focused roles, resist parental involvement, and may underestimate family input, seeing it as a disruption rather than an opportunity asset.

Provider Sensitization and Fatigue: A study described how the primary continuity intensivists and nurses for long-stay patient intervention took a toll on providers, leading to increased stress and decreased flexibility in their work schedules [32]. Healthcare providers, especially in critical care settings, attempt to have an emotional barrier when interacting with critically ill patients to prevent provider sensitization and emotional fatigue. FCC requires healthcare professionals to provide more emotional support to families, which can be emotionally taxing, leading to provider fatigue and reduced engagement, which can negatively impact the sustainability of FCC efforts.

Role Boundary Issues: The Close Collaboration with Parents training program intervention described how nurses can resist parental involvement and feel protective of their profession [23]. This can significantly impact the provision of FCC in these settings and hinder productive family participation.

Cultural and family commitment barriers

Cultural and Traditional Constraints: The integrated family care program in China [21] acknowledged this barrier, where a cultural tradition of "zuo yuezi," which required new mothers to stay at home for one month, hindered their involvement in FCC. The program was successful in improving the healthcare provided in the NICU through FCC and directly impacted objective clinical measures such as increased breastfeeding practices, less enteral nutrition time, more daily weight gain, and significantly lower respiratory support time by involving parents directly in the care of their infants. Other countries may have similar cultural and traditional constraints that may affect the parents' participation in FCC.

High Commitment Requirements for Parents: Two studies focused on leveraging telehealth interventions by providing daily teleconferencing updates for parents and virtual family-centered rounds [18, 20]. These studies recognized that working parents and those with other children find it difficult to engage actively in FCC due to competing commitments. Caring for critically ill children required emotional and physical presence, which was difficult to provide. Through their innovative approach, both interventions provided a convenient solution for both families and healthcare providers in delivering effective FCC.

Communication and collaboration challenges

The study that described FCRs in PICU [28] reported significantly limited participation of non-native-speaking families during their intervention, impacting effective participation in FCC. Information sharing is a core FCC concept that necessitates clear communication between healthcare professionals and families. This gap in communication adversely impacted the delivery of FCC, leaving non-native families feeling excluded and creating a barrier between healthcare professionals and parents.

Environmental constraints

A number of our included studies identified how open wards with limited private spaces may hinder the establishment of a family-friendly environment, with families feeling like visitors in a non-welcoming environment. Moreover, they reported on how critical care areas had strict patient safety policies and infection control measures that may affect the parents' presence. One of these studies involved the hospital leadership in changing the open ward layout to single pod rooms, which alleviated these negative feelings [19]. Other interventions aimed at increasing the visitation times in the critical care area [24] and improving the physical contact between caregivers and hospitalized children [34] were all associated with the successful implication of FCC and positive clinical outcomes without safety concerns.

Training and development needs

One study mentioned how healthcare professionals may not have the skill set required to deliver an effective FCC [24]. Overcoming this barrier necessitated investments in training and professional development by healthcare institutions to enable providers to engage in FCC initiatives. Lack of proper training may lead to inadequate communication skills that obstruct family involvement.

Emotional and psychological stress on families

The primary continuity intensivists and nurses for long-stay patient intervention [32] also reported that the family's journey through their child's critical illness was accompanied by significant emotional stress and anxiety, which may influence how they engage with healthcare professionals. This was illustrated by the fact that parents

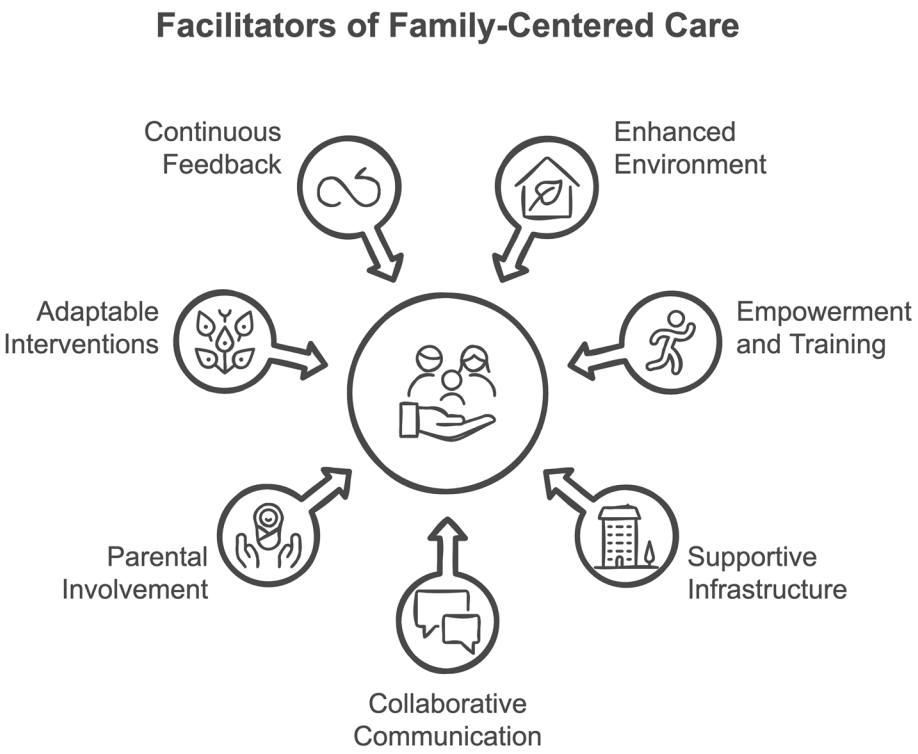

Fig. 3 Identified barriers to family-centered care

were less likely to trust non-primary healthcare providers in caring for their children.

Facilitators to FCC

The interventional methods had several factors that led to the successful implementation of FCC intervention in neonatal and pediatric critical care units (Fig. 3). These facilitators collectively enhanced family involvement, staff engagement, and the overall effectiveness of FCC interventions. We have categorized the main facilitators below:

Enhanced physical environment for family involvement

After identifying that open ward layouts in NICUs can be viewed as a barrier toward FCC, an intervention that created private rooms in the NICU successfully helped parents feel more welcomed and comfortable at the bedside [19]. This fostered a friendly atmosphere and a sense of privacy that alleviated stress, along with an increased sense of respect from staff, making them perceive their infants as more ready for discharge.

Empowerment, training, and skill development

As demonstrated in the Close Collaboration with Parents training program intervention [23], specialized training for healthcare professionals in critical care units improved their skills in active listening, negotiation, and providing family-centered interventions, fostering a collaborative care environment. Another study on the FCC parent participation program [22] reported how regular staff training on FCC principles and practices kept them engaged in delivering FCC at the bedside. Two other interventions also reported how parental training and support helped parents feel more comfortable performing basic nursing tasks for their child [26] and reinforced family unity in the care process [33].

Supportive healthcare infrastructure and culture

Three identified studies highlighted a supportive healthcare infrastructure and culture's positive role in facilitating the smooth and structured implementation of FCC interventions and practices. One study highlighted how a healthcare institution developed managerial FCC committees to provide logistic support, help shape policy, and provide resources for building an infrastructure to deliver effective FCC interventions [24]. Other interventions focused on how progressive cultural changes in care toward FCC enhanced and fostered an environment where families feel valued and empowered as active participants in their child's care [28, 34].

Collaborative communication and transparency

Interventions that established trust through consistent communication, built strong relationships between families and healthcare providers, which was essential for effective FCC. Two studies focused on incorporating an orientation to critical care settings for parents and providing them with standardized educational material, which helped them understand the teamwork dynamics and how to take a proactive role [24, 28]. Another two studies showed how helping healthcare providers appreciate and understand families' feelings during the critical care journey through a diary system [18], or getting to know their patients on a personal level through non-medical bedside boards [29] were strong facilitators in extending the required mutual trust of the FCC. Lastly, another study showed how delivering care to long-term patients by designating primary continuity providers improved communication consistency between families and care teams, ensuring swift and informed decision-making [32].

Parental involvement in care processes

Two studies indicated that giving parents the time and space to actively engage in family-centered rounds allows them to take a more meaningful role in decision-making [27, 28]. This was associated with improved parental satisfaction without negatively affecting workflow, although rounds were marginally longer in one of the studies [28]. Another study on the effectiveness of family integration in the NICU care [25], showed that parents with prior NICU experience can become facilitators in the FCC process through their participation in peer and veteran support groups. This process enabled them to share their experiences and build confidence in the medical teams, alleviating parents'stress in navigating the critical care journey.

Adaptable and scalable FCC interventions

Three studies implemented affordable, adaptable, and cost-effective interventions such as personalized bedside boards [29], diaries [31], and secure digital communication [18]. Introducing FCC interventions that are scalable and affordable can help adapt them to different care settings and broaden their impact.

Continuous feedback and quality control

The PICU diaries intervention included an ongoing evaluation and improvement plan [31]. This ongoing feedback loop helped maintain the intervention's relevance and effectiveness. Gathering feedback from healthcare professionals and parents was essential for establishing a sustainable and stable FCC framework, resulting in a strong institutional commitment to its success.

Discussion

Summary of key findings

In this review, we identified 17 articles exploring FCC interventions in neonatal and pediatric critical care units from two databases. Our goal was to include prospective and randomized controlled trials to ensure comprehensiveness while balancing practicality and available resources within time constraints. This review did not assess the methodological quality of individual studies, which is an optional requirement for scoping reviews [13]; rather, it mapped the literature on interventions with proven efficacy, along with their barriers and facilitators, to support implementation and adoption in various settings. We categorized interventions based on the critical care area—PICU or NICU—and the type of intervention, whether single- or program-based. Most of the identified articles were conducted in Western societies, but there is also a growing interest from Asian countries. This distribution indicates a strong interest in FCC among high-income regions, although middle-income areas are also beginning to adopt and investigate FCC interventions in their communities. This is significant since cultural and traditional differences among communities require careful consideration when implementing an FCC intervention to ensure its success and achieve the desired outcomes.

FCC interventions across NICU and PICU settings

FCC interventions in NICU and PICU settings varied in their design and implementation. NICU had more program-based interventions [21–26], focusing on participation and collaboration by involving parents in basic infant nursing care, such as feeding, hygiene, and increasing physical contact. Based on our review, a possible explanation for this trend is that delivering program-based NICU interventions might be more feasible due to its relatively controlled environment, where infants often require prolonged stays, allowing for the gradual integration of parents into caregiving roles. Furthermore, the age range of children admitted to the PICU is quite broad, which may introduce an additional layer of complexity when introducing a FCC intervention. The only program-based intervention in the PICU was a change initiative to improve physical contact between caregivers and their hospitalized children, which showed its safety and feasibility [34]. These interventions, across NICU and PICU, have consistently been well-received by healthcare professionals and families, and they were linked to significant improvements in clinical outcomes (Table S.1).

In the PICU, single-type interventions included family-centered rounds and innovative communication methods, such as personalized patient bedside boards containing non-medical information, FCC educational handouts, and

PICU diaries for families to document their experiences and communicate with healthcare providers. These tools humanized the clinical space and provided a welcoming environment for families, effectively addressing the information-sharing and participation aspects of the FCC by allowing families to engage in discussions about their child's care actively. Similar interventions were found in adult ICUs that focus on improving communication and reports of improvement in staff confidence, family satisfaction, and reduced distress [35, 36].

Notably, NICU single-type interventions included the use of digital health with interventions such as daily virtual family updates and virtual family rounds that facilitate continuous family engagement. There are key challenges in delivering effective FCC, including restricted parental presence, communication barriers, and provider workload constraints—factors that digital health interventions could help address. Digital health has been a transformative disruption to the status quo of traditional healthcare, with increased interest in its use following the coronavirus pandemic; it has found its way into FCC practice, although more needs to be done, especially in neonatal and pediatric critical care units [37, 38]. A recent systematic review has identified 40 articles about digital health interventions to support family caregivers, and only one intervention included caregivers of patients in the PICU [39]. This highlights that despite the promising role of digital health in enhancing FCC, there remains a significant gap in the development and testing of technology-based interventions specifically tailored to the needs of families in neonatal and pediatric critical care.

Barriers to FCC

We have identified several barriers to implementing FCC interventions in neonatal and pediatric critical care units. While these barriers are similar to those in other settings, they are uniquely relevant in this context. A systematic review of seven studies evaluating the barriers to FCC in adult intensive care units has described several categories that parallel ours [40]. For example, a lack of understanding of what is needed to achieve patient- and family-centered care includes subcategories like those we have identified in our review of role-boundary issues reported by nurses and training and development needs—organization-related barriers in adult settings such as policy constraints, resource limitations, and insufficient private spaces mirror those that are seen pediatric units. Additionally, the attitudes and mindsets of providers, communication challenges, and emotional stress have all been identified as significant barriers for adults that can limit the depth of delivered FCC endeavors [40].

A recent qualitative study describing the perceived barriers of FCC in two NICUs supports our findings by highlighting these barriers from the perspective of families, nurses, midwives, and doctors [41]. They have identified two main themes: family perceived barriers of family stress and anxiety, inadequate information sharing and education, culture, and religion, and the second theme of the facility's perceived barriers of inadequate space and logistics, workload and inadequate staff, restricted entry, and negative staff attitude [41]. These findings underscore the complex nature of FCC barriers, where family and institutional factors contribute to difficulties in implementing family-centered practices in neonatal and pediatric critical care units.

Facilitators of FCC

We have identified several facilitators that were key in the successful implementation of FCC interventions in neonatal and pediatric critical care units. These facilitators were diverse yet played a critical role in creating a welcoming and collaborative environment by providing dedicated family spaces, consistent communication, and structured training for healthcare providers. Moreover, a consistent theme that emerged was the importance of having a supportive infrastructure and higher management support that can easily remove boundaries when delivering FCC. An international qualitative study across 43 countries with the participation of 345 healthcare clinicians of the facilitators and barriers to family engagement in the ICU echo our findings [42]. They have identified three common themes of communication, leadership, and engagement that closely align with our results.

Implications for practice

Effective FCC planning and delivery require a structured, multi-step approach to ensure success. After careful deliberation and evaluating the interventions' procedures for each of the included studies and how the facilitators informed their successful implementation, we propose here a step-by-step model to help plan and deliver successful FCC interventions in neonatal and pediatric critical care units (Fig. 4):

1. Incorporating FCC core concepts at the needs assessment stage: An initial review and assessment of the needs of families, healthcare providers, and institutions to ultimately improve clinical outcomes is an important first step. Revolving the assessment around how the care can be more respectful, information shared transparently, and valuing collaboration and participation in the care delivery ensures that the proposed intervention aligns with the FCC goals.
2. Securing institutional support: To deliver a successful FCC, a cultural shift is required, and it will not

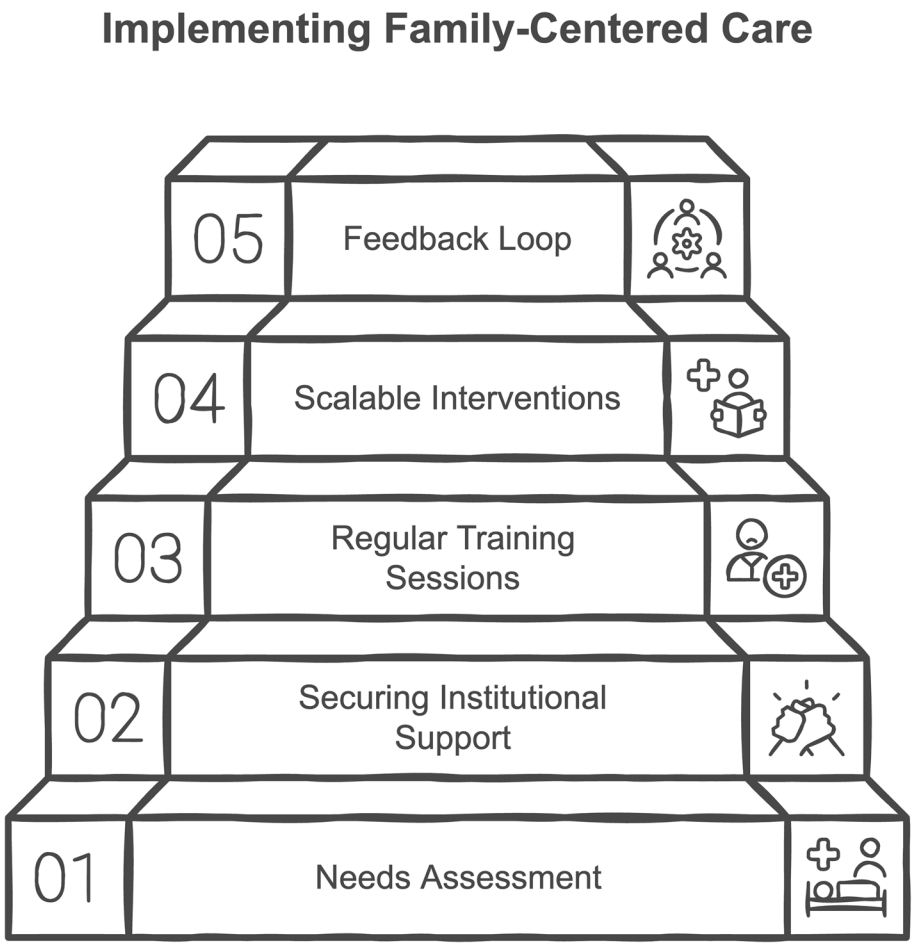

Fig. 4 Steps for implementing family-centered care interventions

happen without firm institutional support. Gaining support from higher management facilitates the implementation and sustainability of FCC as a common practice, and this should be done with a carefully written plan with clear objectives, timelines, and a feedback loop for ongoing quality improvement, keeping in mind that the proposed intervention must be culturally appropriate to maximize acceptance and relevance.

3. Planning regular training sessions: We have observed that training families and healthcare providers is equally important; it should be done regularly for healthcare providers. Training helps instill FCC core concepts and builds a collaborative and supported team that is more engaged in delivering FCC. Incorporating digital tools and standardized materials, such as instructional videos and leaflets, promotes consistency and accessibility.
4. Adopting adaptable and scalable FCC interventions: Introducing adaptable and scalable interventions that are both affordable and acceptable can help sustain FCC interventions, especially in resource-constrained settings. For example, low-cost interventions such as bedside boards containing non-medical information about patients or family-centered rounds are both low-cost and scalable interventions that can be easily implemented with a broad impact. Other program-based interventions can also be delivered through incremental stages using a quality improvement model such as Kotter's 8-Step Change Model [43] or the PDSA cycle (plan, do, study, and act) [44], allowing flexibility and receiving short-term feedback before broadening the intervention further while incorporating a feedback mechanism to foster ongoing commitment to quality improvement.

While our approach does not adhere to a single predefined implementation framework, it conceptually aligns with Kotter's 8-Step Change Model [43], which emphasizes structured change management and stakeholder engagement. Our proposed model is designed to act as a practical guide in designing and implementing FCC

practices but requires testing and validation to assess its real-world applicability. Future research should involve testing this model in various settings and incorporating stakeholder feedback and outcome evaluations to enhance its effectiveness.

Strengths and limitations

Strengths

One strength of this review is its comprehensive approach to identifying FCC interventions, along with their barriers and facilitators, allowing for easier replication of these interventions in diverse contexts. We have used a robust scoping review methodology to synthesize our evidence and were able to capture a wide range of FCC interventions in neonatal and pediatric critical care units. This builds upon the FCC's theoretical foundation and validates the included interventions'relevance to holistic FCC within a clear and simple framework.

Limitations

This scoping review has several limitations. We restricted our search to two databases and excluded non-English publications, which may introduce selection and language bias and limit literature representation from other regions. Nonetheless, identifying interventions from 13 countries across North America, Europe, Asia, and Oceania boosts our confidence in the findings. To establish a reproducible methodology and reduce subjectivity in our selection process, we only included articles that presented an FCC aim in their introduction or methods with FCC-aligned outcomes as defined by FCC principles. This may have contributed to our potential selection bias. Another limitation is that many identified single-type interventions were unique to their own setting, and extrapolating their effectiveness to other settings might not be possible, limiting the generalizability of these interventions. Finally, we did not perform a formal quality assessment of the included studies because it was beyond our scope. However, we chose to include only randomized controlled trials and prospective studies from peer-reviewed publications to ensure a high level of evidence within these constraints.

Directions for future research

Despite identifying several FCC interventions in neonatal and pediatric critical care units, significant gaps remain. Family-centered rounds were the only single-type intervention tested across different settings, and all program-based interventions, except one, were conducted in the NICU. Furthermore, there is a notable scarcity of randomized controlled trials, with only four identified, and most of the studies (11 out of 17) were from Western high-income countries, with limited testing of technology-focused interventions. This indicates ample opportunity for future research and testing innovative technology-focused interventions promoting FCC, which is echoed by the American College of Critical Care Medicine guidelines for FCC in the Neonatal, Pediatric, and Adult ICU where they highlight that all their recommendations were based on weak level evidence and the importance of further research to identify the most effective interventions to improve this critical aspect of ICU care [45]. Given these significant gaps, there are a number of possible directions that we propose researchers can take in this field: investigating the feasibility of more program-based FCC interventions in the PICU, conducting randomized controlled trials to build stronger evidence on the effectiveness of an FCC intervention, incorporating technology-based FCC solutions that are scalable and affordable, and conduct more research in resource-constraint settings and culturally diverse communities.

Conclusion

This scoping review comprehensively reviewed a myriad of FCC interventions in neonatal and pediatric critical care units across diverse settings, highlighting the effect FCC interventions have on families' satisfaction, clinical outcomes, and the quality of care provided. By exploring the barriers and facilitators of FCC, we were able to describe the complexities that healthcare systems need to understand to deliver efficient and effective interventions. We have identified a practical approach to implementing FCC intervention from incorporating FCC core concepts at the stage of assessment needs, securing support from hospital administration, conducting regular and frequent training, selecting adaptable and scalable interventions, and the importance of ongoing feedback. We have also identified the need to introduce innovative technology-based interventions, investigate program-based interventions in the PICU, and conduct high-quality randomized controlled trials. FCC remains an important model of care that healthcare providers and policymakers need to prioritize when delivering care in neonatal and pediatric critical care settings. When the principles of FCC of respect and dignity, information sharing, participation, and collaboration are incorporated into the healthcare culture and providers'mindset, they have the promise of creating a true partnership with families in delivering high-quality care that can transform neonatal and pediatric critical care. This can help patients, families, and healthcare providers navigate the critical care journey while acknowledging its difficulties and responding to their emotional, social, and developmental needs interwoven with clinical excellence.

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions
Authors B.A, H.A., and S.A. contributed to the study's conception and design. Material preparation, article screening, data collection, and analysis were performed by B.A. and H.A.. Article screening and data collection were performed by H.A. and F.A. The first draft of the manuscript was written by B. A. and H.A., and all authors commented on previous versions. All authors read and approved the final manuscript.

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References

1. Pettoello-Mantovani M, et al. Family-oriented and family-centered care in pediatrics. Ital J Pediatr. 2009;35(1):12.
2. Richards CA, et al. Elements of Family-Centered Care in the Pediatric Intensive Care Unit: An Integrative Review. J Hosp Palliat Nurs. 2017;19(3):238–46.
3. Johnson, B.H. and M.R. Abraham, Partnering with patients, residents, and families. A Resource for Leaders of Hospitals, Ambulatory Care Settings, and Long-Term Care Communities, 2012: p. 2012. https://www.ipfcc.org/resources/PartneringwithPatientsandFamilies.pdf.
4. Zolkoski SM, Bullock LM. Resilience in children and youth: A review. Child Youth Serv Rev. 2012;34(12):2295–303.
5. Desai AD, et al. The effectiveness of family-centered transition processes from hospital settings to home: a review of the literature. Hosp Pediatr. 2015;5(4):219–31.
6. Park M, et al. Patient-and family-centered care interventions for improving the quality of health care: A review of systematic reviews. Int J Nurs Stud. 2018;87:69–83.
7. Balbino FS, Balieiro MMFG, Mandetta MA. Measurement of Family-centered care perception and parental stress in a neonatal unit. Rev Lat Am Enfermagem. 2016;24: e2753.
8. Salvador Á, Crespo C, Barros L. The benefits of family-centered care for parental self-efficacy and psychological well-being in parents of children with cancer. J Child Fam Stud. 2019;28:1926–36.
9. Aija A, et al. Parents' presence and participation in medical rounds in 11 European neonatal units. Early Hum Dev. 2019;130:10–6.
10. Sandman L, Munthe C. Shared decision making, paternalism and patient choice. Health Care Anal. 2010;18:60–84.
11. Gasparini R, et al. Policy to practice: increased family presence and the impact on patient- and family-centered care adoption. J Nurs Adm. 2015;45(1):28–34.
12. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19–32.
13. Tricco AC, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Ann Intern Med. 2018;169(7):467–73.
14. Peters MD. In no uncertain terms: the importance of a defined objective in scoping reviews. JBI Database System Rev Implement Rep. 2016;14(2):1–4. https://doi.org/10.11124/jbisrir-2016-2838.
15. Ouzzani M, et al. Rayyan—a web and mobile app for systematic reviews. Syst Rev. 2016;5:1–10.
16. Clarke V, Braun V. Thematic analysis. J Posit Psychol. 2017;12(3):297–8.
17. Page M J, McKenzie J E, Bossuyt P M, Boutron I, Hoffmann T C, Mulrow C D et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. https://doi.org/10.1136/bmj.n71.
18. Epstein EG, et al. Testing the feasibility of Skype and FaceTime updates with parents in the neonatal intensive care unit. Am J Crit Care. 2015;24(4):290–6.
19. Feeley N, et al. A comparative study of mothers of infants hospitalized in an open ward neonatal intensive care unit and a combined pod and single-family room design. BMC Pediatr. 2020;20(1):1–9.
20. Rosenthal J, et al. Virtual Family-Centered Rounds in the Neonatal Intensive Care Unit: A Randomized Controlled Pilot Trial. Acad Pediatr. 2021;21(7):1244–52.
21. He S, et al. Impact of family integrated care on infants' clinical outcomes in two children's hospitals in China: a pre-post intervention study. Ital J Pediatr. 2018;44:1–7.
22. Maria A, et al. Assessment of feasibility and acceptability of family-centered care implemented at a neonatal intensive care unit in India. BMC Pediatr. 2021;21(1):1–12.
23. Toivonen M, et al. Effects of the Close Collaboration With Parents Intervention on the Quality of Family-Centered Care in NICUs. Adv Neonatal Care. 2023;23(3):281–9.
24. Albayrak S, Büyükgönenç L. The impact of family-centered care interventions on neonatal and parental outcomes in a Turkish hospital. Collegian. 2022;29(5):738–47.
25. O'Brien K, et al. Effectiveness of family integrated care in neonatal intensive care units on infant and parent outcomes: a multicentre, multinational, cluster-randomised controlled trial. The Lancet Child & Adolescent Health. 2018;2(4):245–54.
26. Heo Y, Oh W. The effectiveness of a parent participation improvement program for parents on partnership, attachment infant growth in a neonatal intensive care unit: A randomized controlled trial. Int J Nurs Stud. 2019;95:19–27.
27. Ladak L, et al. Family-centered rounds in Pakistani pediatric intensive care settings: Non-randomized pre- and post-study design. Int J Nurs Stud. 2013;50(6):717–26.
28. Levin A, et al. An Evaluation of Family-Centered Rounds in the PICU: Room for Improvement Suggested by Families and Providers. Pediatr Crit Care Med. 2015;16(9):801–7.
29. Spazzapan M, Vijayakumar B, Stewart CE. A bit about me: Bedside boards to create a culture of patient-centered care in pediatric intensive care units (PICUs). J Healthc Risk Manag. 2020;39(3):11–19. https://doi.org/10.1002/jhrm.21387.
30. Chamblee T, Mile D. A prospective study of family engagement for prevention of central line-associated blood stream infections. Pediatr Qual Saff. 2021;6(5):e467.

31. Gawronski O, et al. Implementation of paediatric intensive care unit diaries: Feasibility and opinions of parents and healthcare providers. Aust Crit Care. 2023;36(3):370–7.
32. Edwards J, et al. Parent and Provider Perspectives on Primary Continuity Intensivists and Nurses for Long-Stay Pediatric Intensive Care Unit Patients. Ann Am Thorac Soc. 2023;20(2):269–78.
33. Khaksar S, Kalhor F. Restriction of the family-centered care miracle by COVID-19: the role of the father in sleep disturbance of hospitalized pediatrics. SLEEP SCIENCE. 2022;15(4):407–15.
34. Leland BD, Nitu ME, Hancock M, Moody K, Gunderman R, Moser E, Rowan CM. Prospective evaluation of physical Contact with Critically Ill child on caregiver spiritual wellbeing. J Pediatr. 2017;191:250–4.e1. https://doi.org/10.1016/j.jpeds.2017.08.022.
35. Shaw DJ, et al. Multidisciplinary team training to enhance family communication in the ICU. Crit Care Med. 2014;42(2):265–71.
36. Scheunemann LP, et al. Randomized, controlled trials of interventions to improve communication in intensive care: a systematic review. Chest. 2011;139(3):543–54.
37. Hart JL, et al. Family-centered care during the COVID-19 era. J Pain Symptom Manage. 2020;60(2):e93–7.
38. Meskó B, Drobni Z, Bényei É, Gergely B, Győrffy Z. Digital health is a cultural transformation of traditional healthcare. mHealth. 2017;3:38. https://doi.org/10.21037/mhealth.2017.08.07.
39. Zhai S, et al. Digital health interventions to support family caregivers: An updated systematic review. Digital health. 2023;9:20552076231171970.
40. Kiwanuka F, Shayan SJ, Tolulope AA. Barriers to patient and family-centred care in adult intensive care units: A systematic review. Nurs Open. 2019;6(3):676–84.
41. Abukari AS, Schmollgruber S. Perceived barriers of family-centred care in neonatal intensive care units: A qualitative study. Nurs Crit Care. 2024;29(5):905–15. https://doi.org/10.1111/nicc.13031.
42. Hamilton R, et al. International facilitators and barriers to family engagement in the ICU: Results of a qualitative analysis. J Crit Care. 2020;58:72–7.
43. Kotter JP, Cohen DS. The heart of change: real-life stories of how people change their organizations. 2012. Harvard business review press. https://books.google.com.sa/books?id=cYJnCQURJ5gC.
44. Christoff P. Running PDSA cycles. Curr Probl Pediatr Adolesc Health Care. 2018;48(8):198–201.
45. Davidson JE, et al. Guidelines for family-centered care in the neonatal, pediatric, and adult ICU. Crit Care Med. 2017;45(1):103–28.

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