

## Review Article

## Humanisation in paediatric intensive care units: A narrative review

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## ABSTRACT

**Objective:** To identify findings in the scientific literature relevant to the strategic lines proposed by the Humanising Intensive Care Project in the context of paediatric intensive care units.

**Design:** Narrative review.

**Methods:** A literature search was conducted in the databases PubMed, Scopus, CINAHL, and Cochrane Library. Specific indexing terms and search strategies adapted to each database were designed. The inclusion of publications was based on two criteria: 1) related to the paediatric intensive care unit and 2) addresses at least one of the topics related to the strategic lines of the Humanising Intensive Care Project. Study selection was carried out following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines and the quality of the included studies was assessed using the Mixed Method Appraisal tool.

**Results:** A total of 100 articles from 19 different countries were included, covering the period between 2019 and 2021. Nineteen different design types were identified. Thirty-two studies were cross-sectional observational studies, while 15 had an experimental approach. The articles were distributed among the seven strategic lines of the Humanising Intensive Care Project.

**Conclusions:** Synthesising the knowledge related to humanisation in paediatric intensive care units will allow progress to be made in improving quality in these units. However, there is disparity in the amount of experimental research overall.

**Implications for clinical practice:** There is a disparity in the available research related to the different strategic lines, and it is necessary to carry out more exhaustive research on topics such as the presence and participation of the family in care or the management of post-paediatric intensive care syndrome.

## Introduction

In recent decades, increasing healthcare superspecialisation has brought with it the mechanisation, technification and collectivisation of care, leading the patient to be displaced from the centre of healthcare (Alonso-Ovies and Heras La Calle, 2016; Heras la Calle and Zaforteza, 2014; Trainini, 2020; Zaforteza and Heras, 2017). Under this new paradigm—which is contrary to the bioethical principles proposed by Beauchamps and Childress (2009) and the International Council of Nurses Code of Ethics for Nurses (2021)—it has become more difficult to see patients as human beings who feel and suffer. This phenomenon, known as dehumanisation, is a complex and multifactorial process that objectifies people (Bermejo, 2014; March, 2017; Haque and Waytz,

2012).

However, at the beginning of the 21st century, health organisations, aware of the need to address the psychosocial aspects of patients, began to take an interest in the different humanisation programmes that were being developed in countries such as Brazil (National Humanisation Policy), the United States (Patient and Family Centered Care), and Europe (Child-Friendly Health Care). The purpose of these programmes was to provide kinder and more respectful care to patients and their loved ones (Frechette et al., 2019; Kuo et al., 2012; Tripodi et al., 2017).

In Europe, humanisation policies have been developed on the basis of the Declaration of the Rights of the Child adopted at the United Nations General Assembly in 1959 (Humanium, 2023) and the four principles that guide how these rights are fulfilled: non-discrimination, the best

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interests of the child to be heard and to have a say, the survival and further development of new technology, and the participation of the family in the child’s care (Oliveros-Donohue, 2015; Tripodi et al., 2017). However, early advances in the development of humanisation policies in paediatrics have not been enough to establish a major programme in the humanisation of paediatric intensive care units (PICUs) (García-Salido and Serrano, 2017; Seoane, 2004; Tagarro et al., 2008).

In contrast, in the context of critically ill adult patients, several significant initiatives have emerged, such as the Humanising Intensive Care (HU-CI) Project. The HU-CI Project emerged in 2014 (Madrid, Spain), as an international multidisciplinary research group that seeks, through participatory and networked research, to humanise intensive care units for adults, taking into account the perspectives of patients, their families, and the professionals who care for them. In order to put this approach into practice, various strategic lines have been defined to organise and structure the different elements that could influence the humanisation of these units (Heras la Calle, 2018; Heras la Calle et al., 2020).

Subsequently, with the aim of significantly reducing the variability of health care and standardising clinical practice to ensure a more equitable provision of care, the promoters of the HU-CI Project used the previously established strategic lines to develop the Manual of Good Practices in Humanisation in ICUs. This document was created with the purpose of certifying compliance with humanisation standards of healthcare organisations, as well as their professionals and the training they receive, through the implementation of 160 good practices (HU-CI Project Certification Working Group, 2019).

In order to adapt the *Manual of Good Practices in Humanisation in the ICU* to the paediatric context, it is first essential to answer the following question: What information does the scientific literature contain about the different strategic lines proposed by the HU-CI Project in the context of PICUs?

Methods

Data sources and searches

The primary search was conducted between November and December 2021 in the following databases: PubMed, Scopus, CINAHL, and Cochrane Library. The terms used are detailed in Table 1.

Search outcomes

A total of 3,492 publications were retrieved from the databases. After applying the predefined search filters, 869 documents were excluded. Two pairs of researchers (JG&PD and JG&MR), working independently and blinded to each other’s evaluations, selected, and evaluated the title and abstract of 986 publications based on inclusion criteria. They then delved into the selected abstracts to ensure that only studies with significant contributions advanced to the next phase. Each article was subsequently thoroughly examined, with assessments focusing on the

Table 1  
Terms used.

MAIN MESH	SECONDARY MESH	STRATEGIC LINE
“intensive care units, paediatric”	“patient participation”	1. Open-door PICU: Presence and participation of the family
	“visitors to patients”	
	“communication”	2. Communication
	“patient satisfaction”	3. Comfort and satisfaction of the patient and family
	“patient comfort”	
	“burnout, professional”	4. Staff care
	“post-intensive care syndrome”	5. Post-intensive care syndrome
	“palliative care”	6. Care at the end of life
	“hospital design and construction”	7. Humanised infrastructure

methodology, results, and conclusions. The final selection, comprising 100 studies, and the summarising of their key contributions were determined by a consensus reached through joint discussions among the researchers. This ensured a synthesis based on profound understanding and impartial evaluation.

Inclusion criteria

The inclusion and eligibility criteria, as well as the characteristics of the publications, were previously defined. To be included in the review, publications had to meet two main criteria: they had to be framed in the context of the PICU and they had to be relevant to at least one of the themes of the strategic lines of the HU-CI Project. The initial search included original articles with full-text versions, published in English and/or Spanish between 2019 and 2021. The selection process is detailed in Fig. 1. For an individual description, please see “Supplementary data 1”.

Quality assessment

We used the tool Mixed Method Appraisal (MMAT) (Hong, et al., 2018) to assess the quality of the included studies. This tool was designed for systematic reviews and can be used to assess the quality of the most common types of studies. In addition, it has been used in more than 100 published systematic reviews, such as the publications by Hilleren et al. (2022) and Grota et al. (2022). The MMAT includes five screening questions for all designs (Hong et al., 2018).

The review revealed that a significant proportion of the studies lacked a clearly articulated research question, necessitating the inclusion of only those with well-defined objectives. Seventeen articles were excluded based on four specific criteria: a lack of relevance and clarity in the outcomes, which did not align directly with our research field (n = 5); the absence of a clear research question and defined objectives (n = 2); the inadequacy of outcome measures, owing to their limited applicability to our context and population (n = 4); and methodological deficiencies, which, in conjunction with other factors, impeded adequate support for the proposed results and conclusions (n = 6).

Following the guidelines of the MMAT, which advises against excluding studies solely based on their methodological quality, our decision was aligned with an emphasis on the relevance and clarity of the research objectives. This strategy enabled a more comprehensive and equitable assessment of the studies, recognising that even those with methodological limitations can offer valuable contributions and highlight significant trends in our field of study.

Data extraction and synthesis

We extracted the following data, categorised into the seven strategic lines proposed by the HU-CI Project: author, year of publication, country, objective, study design, and key findings (Table 2). Please see “Supplementary data 2”. A narrative approach was used to synthesise the information, making it easier to understand the topic of each article, and therefore to contextualise, visualise, and when necessary, problematise it (Zillmer and Díaz-Medina, 2018).

Findings

The 100 studies were from 19 different countries. Fifty-one percent (n = 51) came from the United States (US). The contribution of the remaining countries is shown in “Supplementary data 3”.

In terms of study design, 19 different types of designs were identified. Of these, 32 % (n = 32) were cross-sectional observational studies and only 15 % (n = 15) were experimental. For an individual description, please see “Supplementary data 4”.

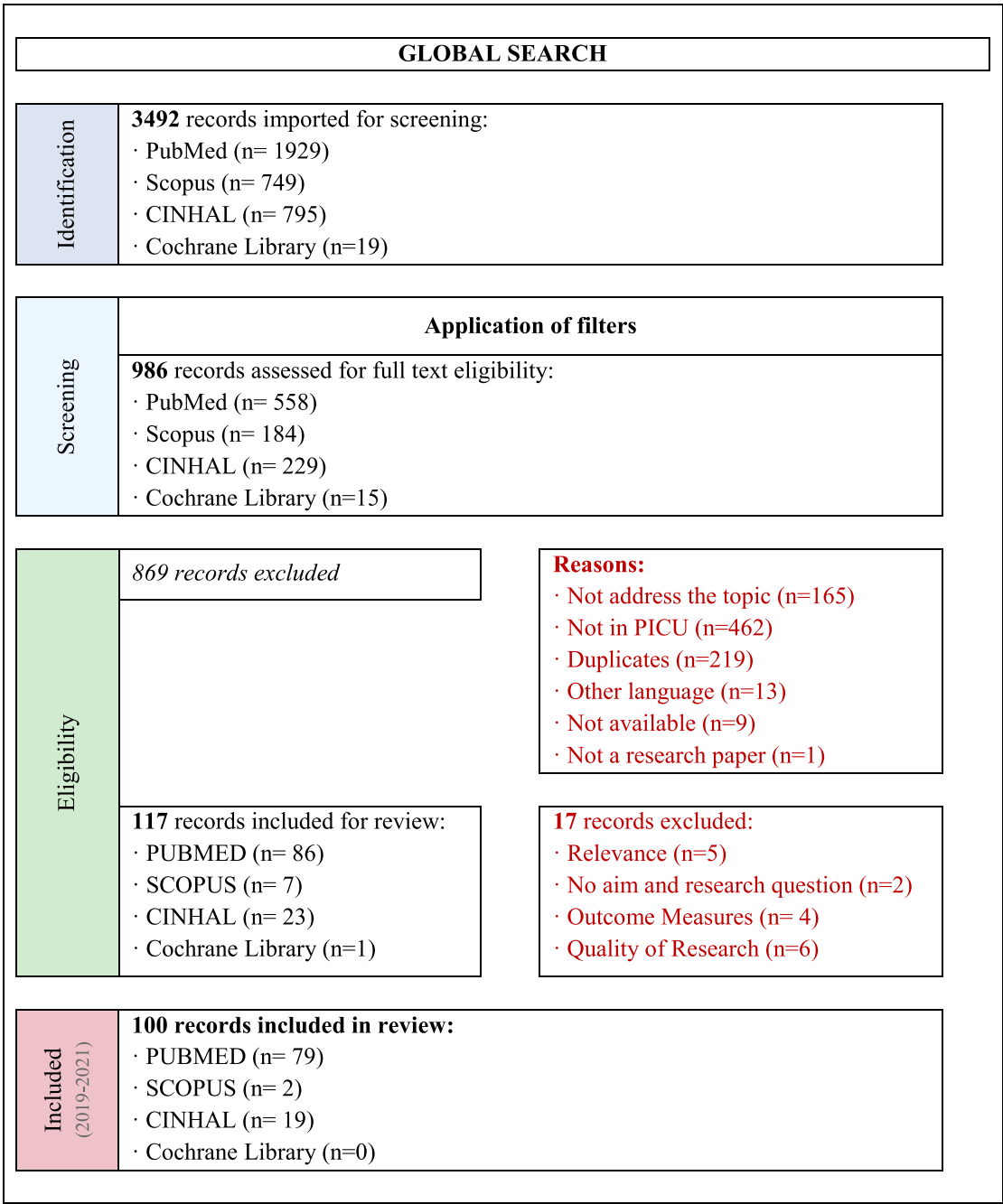


Fig. 1. The screening process.

Open-door PICU: Presence and participation of the family (n = 9)

Various studies agree that the presence and participation of parents in the care of a critically ill child reduce anxiety and improves the overall quality of care received (Hill et al., 2019; Jarvis et al., 2019; Thoele et al., 2020; Uhm and Kim, 2019). However, it is essential that health professionals identify family support systems and promote a continuous, honest, and high-quality exchange of information within an environment that encourages and respects caregivers in daily decision-making, whether in person or online (Bazzan et al., 2021; Hill et al., 2019; Yager, 2020). In recent years, family involvement has been identified as the most significant predictor of early mobility in paediatric patients, regardless of invasive devices or underlying functional status (Choong et al., 2021). Stays in the PICU deserve special attention, since they require prior organisational consensus, due to the need to progressively

prepare all parties (siblings, parents, and professionals) and the need to create private spaces within the structural limitations of the units (González-Gil et al., 2021; Melo et al., 2019).

Communication (n = 21)

Several studies point to communication as the key for empowering families in decision-making and involving them in the process of caring for their loved one (Annuar et al., 2021; Burns et al., 2020; Spazzapan et al., 2020; Wool et al., 2021; Zurca et al., 2020). Findings indicate that this communication must be fluid, warm and understandable, free of technicalisms (Bazzan et al., 2021; Burns et al., 2020), with the main objective of meeting the information needs regarding the physical and emotional health of the child and their prognosis (Michelson et al., 2020; Pasek et al., 2019; Rennick et al., 2019; Rissman et al., 2021).

Uncertainty and unpredictability have been recognised as two of the main elements in negative experiences of parents with hospitalised children (Velandia et al., 2019). In addition to these aspects, there are others, such as inefficiency in coordinating and planning discharge (Hallman and Bellury, 2020; Kobussen et al., 2020), constant interruptions caused by shift changes, or the low value that health professionals place on the family's knowledge of their children's chronic diseases (Greenway et al., 2019).

Regarding communication between professionals, several authors report that effective verbal communication ensures patient safety during critical processes (Aldawood et al., 2020; Rozenfeld et al., 2020), as does holding team meetings before talking with the family to establish a shared therapeutic plan (Walter et al., 2019b,c). Some of the most commonly used techniques or tools to improve communication between teams are skills workshops and debriefings (Gillen et al., 2019; October et al., 2019).

#### *Comfort and satisfaction of the patient and family (n = 19)*

Several studies point to comfort and satisfaction as indispensable for the proper recovery of hospitalised paediatric patients (Bosch-Alcaraz, Jordan, Rodríguez-Martín et al., 2020; Fayed et al., 2020). To this end, health personnel must provide the family unit with optimal measures to ensure physical and emotional well-being, clinical safety, and peace of mind (Da Silva and Fonseca, 2020; Fayed et al., 2020; McAndrew et al., 2020; Soares et al., 2020; Walter et al., 2019a). Some of these measures include providing effective communication tailored to the child's age and caregivers' needs (Ahmed et al., 2019; López et al., 2019; Ratelle et al., 2019); having a single room that allows continuous accompaniment and preserves the privacy of the patient and family (Bosch-Alcaraz, Jordan, Benito-Aracil et al., 2020); having a good catering service (De Monte et al., 2020); encouraging family participation for the prevention of delirium (Colletti-Junior et al., 2020; Silver and Traube, 2019); and providing good pain management and control to reduce the use of sedatives, either using the bispectral index or pharmacokinetics (Bosch-Alcaraz et al., 2021; Lincoln et al., 2020; Tillman et al., 2021) and/or applying non-pharmacological measures, such as music therapy (Liu et al., 2020) or virtual reality (Badke et al., 2019).

#### *Staff care (n = 11)*

In relation to care for professionals, studies estimate that the prevalence of burnout syndrome among professionals working in paediatrics is 40–56 %. In addition, 20–30 % of professionals develop post-traumatic stress disorder, regardless of professional category, gender, and the care unit where they serve (Buckley et al., 2019; Gribben et al., 2019; Matsushita et al., 2021; Park et al., 2020; Richardson & Greenle, 2020; Rodríguez-Rey et al., 2019a, 2019b). One of the most effective strategies to combat burnout is to find meaning in work (Wei et al., 2020). However, several authors claim that a resilience programme aimed at paediatric nurses can mitigate compassion fatigue, post-traumatic stress, and burnout, in addition to reducing the moral distress they experience when ethical conflicts arise over decisions related to care (Buckley et al., 2019; Burton et al., 2020; Flanders et al., 2020).

#### *Post-intensive care syndrome (n = 9)*

Regarding post-intensive care syndrome (PICS), several authors agree that this term is practically unknown to parents of critically ill children, despite being closely related to a loss of quality of life for the family (Esses et al., 2019; Holding et al., 2021; Jarvis et al., 2020; Manning et al., 2021; Hartman et al., 2020). PICS can affect the physical, cognitive, emotional, and social health of the family members who support the child (Woodruff and Choong, 2021). Approximately 10 % of children admitted to the PICU suffer a decrease in functional status, and

4 % manifest cognitive deficits in memory and attention. In addition, an estimated 85 % of school-age children develop sleep disturbances, depressive symptoms, and post-traumatic stress disorders after a stay in the PICU (Bradbury et al., 2021; Hartman et al., 2020; Mathew et al., 2020). The literature suggests that there are iatrogenic and environmental risk factors associated with the occurrence of PICS, such as excessive sedation, prolonged mechanical ventilation, lack of family support, and/or the need to resort to child protection services (Hartman et al., 2020; Williams et al., 2019; Woodruff and Choong, 2021). Given these findings, it is essential that health services inform families about PICS during admission, either through health agents or brochures, with the aim of improving knowledge and the normalisation of PICS (Esses et al., 2019; Hartman et al., 2020). In addition, multidisciplinary follow-up should be provided at discharge to offer support to families through rehabilitation units and strategies focused on participation (Jarvis et al., 2020; Manning et al., 2021).

#### *Care at the end of life (n = 26)*

Studies on end-of-life care show in recent years an increase in the limitation of therapeutic effort in the PICU, with a high prevalence of parental involvement and an increase in the withdrawal of life support (Bennett and LeBaron, 2019; Falkenburg et al., 2020; Furtado et al., 2021). In Spain, from 2011 to 2017, half of the deaths within these medical units were attributed to decisions of this nature, prompted by the adverse progression of the underlying pathology. The most commonly used actions were not initiating CPR in case of cardiac arrest (45 %) and withdrawal of mechanical ventilation (31.5 %) (Agra and MOMUCIP working group, 2019; Bobillo-Pérez et al., 2020). Similar data are provided by the units of countries such as Germany (Furtado et al., 2021). It is clear that the incorporation and uniform implementation of palliative care in the PICU are essential to ensure high-quality care, regardless of the case's complexity or the probability of survival (Delgado-Corcoran et al., 2020, 2021; Grunauer et al., 2021; Moynihan et al., 2019; Rossfeld et al., 2019; Sidgwick et al., 2019; Toulouse et al., 2019). To this end, teams must have specialised palliative care personnel who can integrate palliative care through a staggered approach, applying knowledge and communication skills depending on the stage of the patient (hospitalisation and the dying process) and the needs of the family after death (Broman et al., 2020; Broton et al., 2019; Butler et al., 2019; Das et al., 2019; Iwata et al., 2019; Rothschild et al., 2020; Rothschild and Derrington, 2020).

For effective communication to occur in this context, the entire care team must be able to convey messages—especially bad news—in language that is understandable, comforting, and devoid of stress (Lewis-Newby et al., 2020; Mesukko et al., 2020; Mitchell et al., 2019; Neis et al., 2020; Rothschild et al., 2020; Rothschild and Derrington, 2020). Regarding healthcare staff, PICU nurses have poor coping skills related to death and suffer moral distress as a result of end-of-life care (Garten et al., 2021; Lledó-Morena and Bosch-Alcaraz, 2021). This phenomenon could be reduced by having sufficient time for communication and developing multidisciplinary educational programs (Garten et al., 2021; Seino et al., 2019).

#### *Humanised infrastructure (n = 5)*

Finally, in relation to this strategic line, one of the aspects most highly appreciated by parents of children admitted to the PICU is having a private room, because this feature preserves family relationships, grants privacy, provides peace of mind (Bosch-Alcaraz et al., 2021; Cardoso et al., 2021; Hasegawa et al., 2020), and decreases the amount of perceived noise from facilities, people, and alarms, which has been shown to be between 30 and 40 dB in the morning and 20 and 30 dB at night (Jung et al., 2020). However, these new settings have been linked to increased difficulty in monitoring patients' vital signs, directly affecting their safety (Frechette et al., 2019). In addition, nurses run the



risk of neglecting their care responsibilities to assume the role of porter or guard, by having to authorise or limit the number of daily visits or prevent family members from eating inside the rooms (Frechette et al., 2020).

## Discussion

Within the framework of this review, for the first strategic line *open-door PICU: presence and participation of the family*, a total of nine articles were examined, of which three were found to address research from a qualitative perspective. These articles underline the necessity to transform PICUs to become more welcoming, by establishing private spaces and rest areas that enable families to remain close to their children in a secure environment (Bazzan et al., 2019; Choong et al., 2021; Hill et al., 2019). Moreover, the need to actively engage families in the care of their children is emphasised through programmes that allow them to partake in daily activities and basic procedures, thus enhancing emotional support and the emotional bonds amongst them (Jarvis et al., 2019; Melo et al., 2019; Uhm and Kim, 2019; Yager, 2020).

However, the limited set of articles in this area compared to the other areas highlights a clear gap in the existing knowledge. In this sense, it is imperative to undertake a greater number of studies related to *open-door PICU*, in order to shed light on the aspects still unexplored and thus enrich our overall understanding of the interaction between families and health professionals. In addition, it is necessary to explore the optimal implementation of sibling visits in the PICU.

In the second strategic line, *Communication*, we observed that about half of the articles reviewed used observational descriptive designs ( $n = 9$ ), while there was a notable lack of experimental studies. The overall results of these studies underscore the importance of implementing training workshops for staff, focused on improving communication with families through clear and empathetic language. These workshops aim to facilitate a greater understanding and provide emotional support, which are crucial elements in the delicate context of PICUs (Bazzan et al., 2021; Burns et al., 2020; Lynch et al., 2019; October et al., 2019; Wool et al., 2021; Velandia et al., 2019). Moreover, there is an emphasis on developing and utilising standardised discharge planning tools to optimise discharge preparation, ensuring that families are well-informed and prepared for care post-hospitalisation (Greenway et al., 2019; Kobussen et al., 2020; Rennick et al., 2019; Rissman et al., 2021).

The absence of experimental research limits a deeper understanding of the most effective interventions and strategies that could improve the quality of communication. Such research could explore, for example, how certain communication strategies affect families' understanding of information or could help assess the effectiveness of tools and training designed to improve communication, thus providing concrete evidence on their impact compared to control groups.

Within the third strategic line on the *comfort and satisfaction of the patient and family*, a total of 19 studies were evaluated, with three narrative reviews being noteworthy. This fact could be interpreted as an indication of the interest and complexity inherent in the topic under investigation. The findings from these studies highlight the importance of designing rooms in PICUs that enhance privacy and comfort for both patients and their families, incorporating elements that allow for the personalisation of the space and create an environment conducive to recovery (Bosch-Alcaraz et al., 2020b; De Monte et al., 2020; Silver and Traube, 2019; Soares et al., 2020). Furthermore, they advocate for an increased use of non-pharmacological measures for managing pain and anxiety as part of daily care, offering alternatives that significantly improve the well-being of patients (Badke et al., 2019; Bosch-Alcaraz et al., 2021; Clark et al., 2019; Lincoln et al., 2020; Liu et al., 2020; Tillman et al., 2021).

Carrying out experimental studies in this domain could allow for the identification of causal relationships and provide evidence that facilitates better decision-making. For example, the impact of sensory therapy interventions, such as aromatherapy or music therapy, could be

explored by measuring cortisol levels and other physiological responses to assess the efficacy of these interventions in improving well-being.

A total of 11 articles were examined in the fourth strategic line, *staff care*, with a clear predominance of observational studies ( $n = 7$ ). The research findings emphasise the importance of psychological support and resilience programmes for healthcare staff, providing effective self-care tools and strategies to manage work-related stress. They also highlight the need for adopting proactive measures to prevent professional burnout, including adjustments in work schedules and access to psychological services, with the aim of promoting a healthy and resilient work environment (Buckley et al., 2019; Burton et al., 2020; Çalışır et al., 2020; Flanders et al., 2020; Wei et al., 2020).

Within the fifth strategic line, *post-intensive care syndrome*, nine articles of different nature were analysed, a figure that highlights the still limited existing literature in on PICS in the paediatric context. The findings from various studies emphasise the need to inform and educate families about PICS, providing resources that facilitate their management and understanding (Esses et al., 2019; Hartman et al., 2020; Holding et al., 2021; Jarvis et al., 2020; Manning et al., 2021). In addition, there is advocacy for the establishment of post-PICU follow-up protocols that coordinate rehabilitation and emotional support services, ensuring a comprehensive long-term recovery for both patients and families (Jarvis et al., 2020; Manning et al., 2021). This research sheds light on complex and interconnected aspects that influence the well-being of patients and their families after their time in the PICU.

Possible avenues of research could include raising awareness and educating professionals about iatrogenic and environmental factors linked to daily practice, in order to examine how awareness of these factors can influence decision-making and the adoption of safer practices.

In the sixth strategic line, *care at the end of life*, a total of 26 articles were explored, underlining the significant attention being paid in this area. The studies provide insights into the significance of training staff in communication skills to support and accompany families during critical end-of-life decisions (Mesukko et al., 2020; Neis et al., 2020; Rothschild et al., 2020). Furthermore, they underscore the importance of having or integrating specialised palliative care teams within PICUs, capable of providing specialised support during these challenging stages (Delgado-Corcoran et al., 2020; Delgado-Corcoran et al., 2021; Grunauer et al., 2021; Moynihan et al., 2019; Toulouse et al., 2019).

The qualitative perspective makes it possible to describe the experiences of children in the PICU and of people who are in close contact with them. In contrast, quantitative measures, while useful in assessing the effectiveness of interventions, may encounter limitations in their ability to fully encompass the richness and depth of such experiences.

Finally, within the seventh strategic line, *humanised infrastructure*, five articles were examined, highlighting the limited base of literature in this area. The key findings of the research highlight the importance of having individual rooms in the PICU that provide privacy and comfort during health care (Cardoso et al., 2021; Hasegawa et al., 2020; Jung et al., 2020). Additionally, they emphasise the need to implement architectural and technological solutions to minimise ambient noise, thereby creating a quieter and more conducive environment for patient recovery (Frechette et al., 2019, 2020).

The paucity of studies focusing on humanised infrastructure in the PICU can be attributed to a number of interrelated factors. Care in the PICU has been oriented towards health and technical aspects, focusing on physical survival and treatments, regardless of environmental factors. To this end, as Gómez-Tello and Ferrero (2016) point out, a thorough analysis of each unit is essential, identifying needs and establishing priorities for action. Importantly, however, the solutions may pose financial and logistical challenges for healthcare organisations.

## Limitations

The scope of the literature search was deliberately narrowed to

encompass the years 2019 to 2021, with the analysis of the data has been limited to the seven strategic lines proposed by the HU-CI Project. This temporal delimitation was selected to guarantee a concentration on the latest practices and insights. Nonetheless, this constraint might have led to the omission of pertinent evidence from preceding years that remains of potential significance. Despite its thoroughness, it is possible that the HU-CI Project has overlooked other relevant factors that could influence the humanisation of care in the PICU. For a more complete and holistic understanding of this topic, it would be necessary to consider whether other variables might play an important role in improving care in this setting.

Notably, this review did not examine in detail the barriers inherent to the implementation of these practices in critical care units. These difficulties may include resource limitations, insufficient training, resistance to change, and cultural obstacles. Lack of consideration of these barriers could limit the full understanding of the challenges associated with the successful implementation of improvement strategies in the PICU setting.

## Conclusion

The studies analysed underline the need to undertake research projects with experimental designs, in order to strengthen the findings obtained and have more robust, generalisable conclusions.

Additionally, we found that not all strategic lines have been researched to the same degree. There is a disparity in the available research related to the different strategic lines, and it is necessary to carry out more exhaustive research on topics such as the presence and participation of the family in care or the prevention and treatment of professional burnout.

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## CRediT authorship contribution statement

**Javier García-Fernández:** Writing – original draft, Visualization, Project administration, Investigation, Funding acquisition. **Marta Romero-García:** Writing – review & editing, Visualization, Supervision, Project administration, Investigation, Conceptualization. **Lúcia Benito-Aracil:** Writing – review & editing. **Mª Pilar Delgado-Hito:** Writing – review & editing, Visualization, Supervision, Project administration, Investigation, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.iccn.2024.103725>.

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