



Implementation of good humanization practices in a pediatric intensive care unit: An audit and feedback quality improvement study

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ABSTRACT

Objectives: To describe the implementation of the *Manual of Good Practices in Humanization in Pediatric Intensive Care Units* through an Audit and Feedback strategy and examine observed changes in compliance in a high-complexity unit.

Methods: A comparative longitudinal observational study (pre–post) was conducted from January to December 2025 in a high-complexity pediatric intensive care unit in Spain. The implementation process followed a 12-month Audit and Feedback cycle structured in four phases: baseline audit, participatory prioritization, decentralized protocol development, and final evaluation. Compliance with 127 evaluable good practices was measured, and 95% confidence intervals were calculated using the Wilson score method.

Results: Baseline compliance was 69.3% (88/127; 95% CI: 60.8–76.6). At final evaluation, overall compliance reached 72.4% (92/127; 95% CI: 64.1–79.5), representing an absolute increase of 3.1 percentage points (95% CI: –7.9 to +14.2). The prioritized strategic lines of Communication and Patient well-being showed gains of 14.3 and 8.3 percentage points, respectively; however, overlapping confidence intervals indicate that these changes cannot be distinguished from sampling variability. Among unimplemented practices, 87.2% required organizational and training actions, while 12.8% required direct financial investment.

Conclusions: This implementation-focused quality improvement study suggests that Audit and Feedback may be feasible for structuring the monitoring, prioritization, and adoption of humanization practices in a high-complexity pediatric intensive care unit. Modest quantitative changes and organizational outputs were observed, but these findings cannot be considered evidence of intervention effectiveness. Future cycles should assess sustainability and incorporate patient- and family-level outcomes.

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Introduction

The demand for pediatric critical care has grown steadily over the past two decades, driven by an increasingly complex patient profile with greater technological dependence. This trend is reflected both in the United States, where the proportion of hospitalizations requiring admission to a pediatric intensive care unit (PICU) increased from 10.6% to 15.5% between 2001 and 2019 (Killien et al., 2023), and in Spain, which has 52 PICUs and expanded its capacity from 387 to 417

beds, between 2022 and 2024 (Asociación Española de Pediatría, 2024; Sociedad Española de Cuidados Intensivos Pediátricos, 2022). However, this growth has been accompanied by an increasingly mechanized model of care in which the child–family unit tends to be displaced from the center of attention (Alonso-Ovies & Heras La Calle, 2016; Secunda & Kruser, 2022). Within the PICU environment, exposure to invasive procedures, the presence of life-support equipment, and separation from the family unit increase the risk of long-term physical, psychological, and emotional sequelae, collectively described as pediatric post-intensive care syndrome (PICS-p) (Paul et al., 2024; Tang et al., 2021).

In this context, the humanization of care has gained recognition as a component of healthcare quality. While the patient- and family-

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centered care model focuses on the relationship between the healthcare team and the patient–family unit, humanization proposes a more systemic approach that explicitly incorporates staff well-being and infrastructure conditions as interdependent dimensions of care quality (García-Fernández et al., 2024; Nielsen et al., 2023; Reyes-Téllez et al., 2024). Humanization encompasses a broad spectrum of practices, from optimizing the sensory environment to promote physiological sleep (Hassinger et al., 2023; Smith et al., 2022) to integrating primary caregivers as active partners in the early detection of clinical deterioration (Mills et al., 2025). Available evidence suggests that these strategies may reduce the need for deep sedation, decrease the incidence of delirium, and mitigate the severity of PICS-p (Davidson et al., 2017; Paul et al., 2024; Williams et al., 2025).

However, one of the main barriers to the systematic implementation of humanization has been the difficulty of translating it into objective, auditable indicators. The Humanizing Intensive Care Project (HU-CI, from the Spanish “Humanizando los Cuidados Intensivos”), initiated in Spain in 2014, demonstrated the feasibility of this process in the adult setting by systematizing good practices into measurable clinical indicators (HU-CI Project Certification Working Group, 2019). This precedent was subsequently transferred to pediatric critical care: through a methodological study using the Delphi technique, 132 good practices were validated and structured into a humanization manual for PICUs, organized around seven strategic areas: open doors and family participation, communication, patient well-being, care for staff, PICS-p and discharge preparation, end-of-life care, and infrastructure (García-Fernández et al., 2026; HU-CIP Project Certification Working Group, 2024).

Yet diagnostic evaluation alone is insufficient to drive change. The Audit and Feedback (A&F) strategy offers a mechanism to bridge the gap between evidence and clinical practice by evaluating compliance with pre-established criteria and providing structured feedback to professionals (Colquhoun et al., 2017; Ivers et al., 2012). A&F is intended to support behavior change by providing professionals with data on their actual practice compared to a reference standard, thereby identifying gaps and informing improvement priorities. Evidence from Cochrane reviews indicates that the successful implementation of A&F depends on feedback that is specific, actionable, and delivered by a reliable source, as well as on team ownership and a responsive organizational culture (Sarkies et al., 2023). Locally led improvement models have demonstrated greater sustainability than top-down strategies (Michl et al., 2024; Shah & Sunol, 2024). Although A&F has been widely used for traditional clinical indicators—such as hand hygiene compliance, ventilator-associated pneumonia bundles, or medication safety protocols—evidence regarding its application to PICU humanization remains limited (Han & Liang, 2024; Hysong et al., 2006).

This study addresses this gap by describing the implementation of the *Manual of Good Practices in Humanization in Pediatric Intensive Care Units* through an A&F strategy in a high-complexity PICU. Specifically, it examines changes in compliance with humanization practices over a 12-month A&F cycle and explores the organizational outputs generated during the process.

Methods

Study design

A comparative longitudinal observational study (pre–post) was carried out between January and December 2025 in a high-complexity PICU in Barcelona, Spain, following the *Standards for Quality Improvement Reporting Excellence 2.0* guidelines (Ogrinc et al., 2016). As improvement decisions were made autonomously by the clinical team in response to audit feedback, without researcher-controlled manipulation between measurements, the study was framed as an implementation-focused quality improvement study rather than as an effectiveness evaluation (Grimes & Schulz, 2002).

Context

The study was carried out at the Vall d’Hebron University Hospital, a tertiary academic center with universal coverage that acts as a national reference (Double (“)). The A&F cycle was carried out in the PICU of the Children’s Hospital, a high-complexity multipurpose medical-surgical unit equipped with 16 beds (12 single rooms and 4 open bays) that represents approximately 25% of the pediatric intensive care capacity of the region. The unit offers care to patients from age 1 month to age 16 years, with 637 admissions in 2024, under a care model based on an open-door policy and continuous family accompaniment. The care profile is characterized by maximum technical complexity, including an extracorporeal membrane oxygenation program, solid organ transplantation (cardiac, pulmonary, hepatic, and renal), neurocritical care, and comprehensive management of the polytraumatic and severely burned patient. The structural and organizational characteristics of the unit, including staffing and nurse-to-patient ratios, are detailed in Table 1.

Research team

The study was conducted by a two-member research team. The principal investigator, external to the unit during the study period, was responsible for the design, methodological coordination, and data analysis; this external position contributed to reducing potential bias in data collection. The local investigator, who was the nursing supervisor of the unit, coordinated the implementation process and follow-up activities with the multidisciplinary team, with the support of a clinical nurse specialist who provides research and implementation support within the unit. Both investigators jointly participated in the baseline audit (phase 1) and final evaluation (phase 4), resolving discrepancies by consensus based on documentary evidence.

Intervention

The implementation process consisted of the systematic application of the *Manual of Good Practices in Humanization in Pediatric Intensive*

Table 1
Structural, organizational, and staffing profile of the PICU.

Feature	Description
<i>Institutional features</i>	
Ownership and management	Public
Complexity level	Level 4 ^a
Academic affiliation	University hospital
<i>Structural characteristics</i>	
Type of care	Medical-surgical (multipurpose)
Population	Pediatric only, 1 month–16 years
Capacity (beds)	16 beds: 12 single rooms and 4 open bays
<i>Accompaniment and visitation policy</i>	
Caregiver accompaniment	24 h (for all patients)
Visits (extended family/friends)	Flexible (for all patients)
<i>Human resources</i>	
Staff (nurses / nursing assistants / physicians)	54 / 20 / 14
Nurse-to-patient ratio	1:2 (stable) / 1:1 (highly complex)
Nursing assistant-to-patient ratio	1:4
Physician-to-patient ratio	1:2.5 (workday) / 1:8 (nights and weekends)
Interdisciplinary support ^b	Physiotherapist, psychologist, social worker

Note. PICU = pediatric intensive care unit.

^a Maximum complexity level according to the classification of pediatric intensive care units established by the Spanish Association of Pediatrics (*Asociación Española de Pediatría*, 2024).

^b Available via interconsultation.

Care Units (García-Fernández et al., 2026), a validated instrument that organizes 132 practices into seven strategic lines and three levels of complexity—basic ($n = 86$), advanced ($n = 29$), and excellent ($n = 17$)—designed to guide progressive implementation. The strategic lines are 1. PICU open doors and family participation in care ($n = 20$), 2. Communication ($n = 15$), 3. Patient well-being ($n = 26$), 4. Care for staff ($n = 14$), 5. Pediatric post-intensive care syndrome and discharge preparation ($n = 12$), 6. Care at end of life ($n = 22$), and 7. Infrastructure ($n = 23$).

The methodological process was based on the A&F cycle, covering a period of 12 months (January–December 2025), divided into four sequential phases: 1. baseline audit (1 month), 2. feedback and prioritization (1 month), 3. development and implementation (9 months), and 4. final evaluation (1 month).

The baseline audit (phase 1) used the *Manual* to assess initial compliance with humanization practices in the unit. We used source triangulation to strengthen data reliability and minimize bias: direct observation in situ, review of clinical records, and interviews with those responsible for the unit. Practices identified as “in progress” during this phase were excluded from the comparative analysis because active improvement work had already begun before the A&F cycle. Including these practices could have attributed pre-existing implementation efforts to the study cycle and overestimated the observed change during the A&F process.

The feedback and prioritization phase (phase 2) was carried out through a 90-min in-person deliberative session, with the participation of the nursing management team and the pre-existing humanization working group (composed of ten nurses, two nursing assistants, and one physician). During the session, the findings of the baseline audit were presented. For the selection of target practices, we started from a preliminary proposal suggested by the management team, which was discussed and voted on by the attendees. The final choice of target practices was agreed upon based on their relevance to the patient and family experience, organizational feasibility, and availability of resources.

Subsequently, in the development and implementation phase (phase 3), we adopted a decentralized model. The members of the working group from phase 2 were divided into five subgroups based on their preferences and areas of expertise. Four subgroups, each composed of approximately three working group members, were responsible for the development of care protocols aimed at standardizing new practices in the unit. The fifth subgroup, led by the local investigator and the clinical nurse specialist, assumed responsibility for the two training-related practices, given that the development of training programs requires institutional coordination and formal approval processes. Quarterly monitoring was conducted to facilitate the dynamic adaptation of the practices to the care reality of the unit, addressing operational barriers and fostering team engagement. The final evaluation (phase 4) replicated the method of phase 1 to enable direct

comparison between both time points. The detailed schedule and specific methodological activities of each phase are described in Table 2 and summarized schematically in Fig. 1. To describe observed changes during the A&F cycle, compliance indicators and documentary records were compared between the baseline audit (phase 1) and final evaluation (phase 4).

Measures

The main measure was overall compliance with the *Manual*, defined as the percentage of the 132 good practices categorized as implemented. The secondary analysis evaluated compliance according to the seven strategic lines. Data were recorded on the REDCap® platform (Harris et al., 2009), where we categorized each practice as “implemented” (integrated into the care routine), “in progress” (under development), or “not implemented” (absence of evidence).

Data analysis

The data analysis integrated descriptive quantitative analysis and qualitative characterization of implementation gaps. Statistical analyses were performed using the IBM SPSS Statistics software, version 27.0 (IBM Corp, 2020). Results were expressed in absolute and relative frequencies. The percentage of practices in compliance was compared between the baseline audit and the final evaluation for each strategic line and overall. Proportions and their 95% confidence intervals (CIs) were estimated using the Wilson score method (Newcombe, 1998), considered appropriate given that the 132 practices represent the complete set of the instrument evaluated in a single unit. Since the available dataset included aggregated counts (number of compliant practices at each time point) rather than item-level paired data, paired analyses were not feasible.

The absolute change (Δ , percentage points) between the baseline audit and the final evaluation was reported for each strategic line. No formal inferential hypothesis testing was performed because this was a single-unit, uncontrolled, observational implementation study with a descriptive purpose. Therefore, the analysis focused on observed proportions, confidence intervals, and absolute changes over time rather than on testing intervention effectiveness. As a sensitivity analysis, the 95% CI for Δ was calculated assuming independence between measurements, following the method described above.

Ethical considerations

The study was approved by the Clinical Research Ethics Committee of the Vall d'Hebron University Hospital (reference: PR(AMI) 241/2022). As it is a quality improvement study focused on organizational processes and not on clinical data from individual patients, the study

Table 2
Timeline and operational description of the audit and feedback cycle.

Phase	Period	Objective	Main activities
Phase 1: Baseline audit	January 2025	Assess initial compliance with humanization practices	Assessment of 132 practices using the <i>Manual</i> ; source triangulation; identification of “in progress” practices for exclusion from the comparative analysis
Phase 2: Feedback and prioritization	February 2025	Prioritize target practices through a participatory process	Feedback session with the multidisciplinary team; participatory prioritization based on relevance to patient and family experience, organizational feasibility, and available resources; selection of target practices and designation of leads
Phase 3: Development and implementation	March–November 2025	Develop and implement selected practices through a decentralized structure	Development of care protocols; training activities; quarterly monitoring to identify operational barriers and adapt the schedule to unit needs
Phase 4: Final evaluation	December 2025	Describe observed changes in compliance and organizational outputs	Reassessment using the same method as Phase 1; calculation of absolute change in compliance between baseline and final evaluation; documentation of organizational outputs and pending practices.

Note. A&F = Audit and Feedback.

12-month Audit and Feedback cycle

January – December 2025

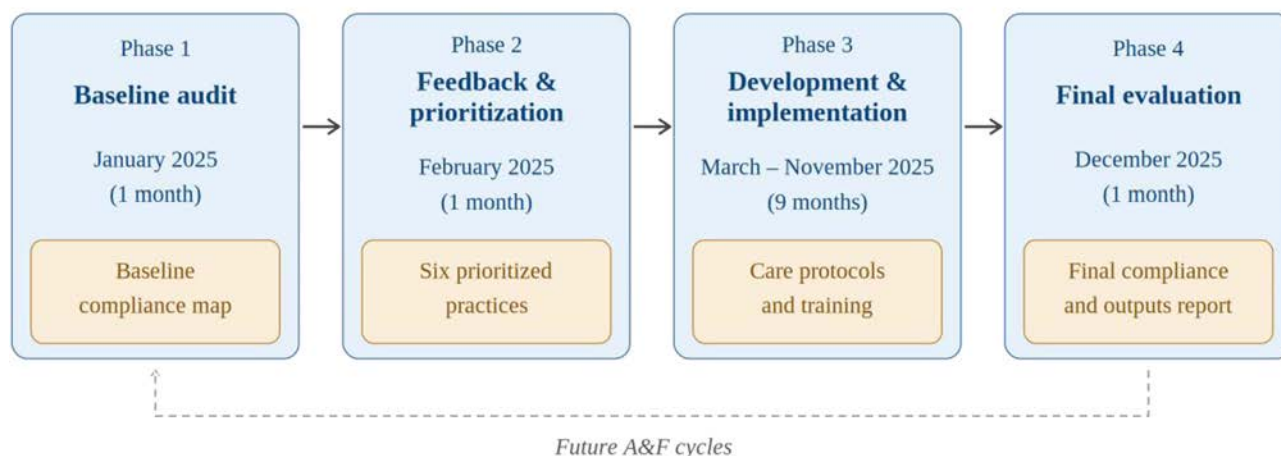


Fig. 1. Schematic representation of the 12-month audit and feedback cycle.

Note. The cycle was structured in four sequential phases: baseline audit, feedback and prioritization, development and implementation, and final evaluation. Each phase produced a specific organizational output, shown in the embedded output box. The dashed return arrow indicates the iterative nature of the A&F strategy, with outputs and lessons learned feeding into future cycles. Detailed activities for each phase are described in Table 2.

was exempted from requesting informed consent. The participation of the professionals was voluntary, and the confidentiality of the information collected was guaranteed.

Results

Phase 1. Baseline audit results

The baseline audit (January 2025) showed overall compliance with good practices of 66.7% (88/132). However, five practices (3.8%)—distributed across Line 1. PICU open doors and family participation in care ($n = 1$), Line 2. Communication ($n = 1$), Line 3. Patient well-being ($n = 2$), and Line 4. Care for staff ($n = 1$)—were already undergoing active improvement prior to the assessment. These practices were excluded from the comparative analysis to avoid attributing pre-existing improvement efforts to changes observed during the A&F cycle. Consequently, the adjusted denominator for the baseline–final evaluation comparative analysis was set to 127 items, yielding an adjusted baseline compliance rate of 69.3% (88/127).

Table 3

Baseline audit results: compliance with humanization practices by strategic line.

Strategic line	Implemented items / total items	Complexity level			"In progress" items
		Basic	Advanced	Excellent	
1. PICU open doors and family participation in care	13 / 20 (65.0%)	6 / 10 (60.0%)	6 / 8 (75.0%)	1 / 2 (50.0%)	1 / 7 (14.3%)
2. Communication	9 / 15 (60.0%)	5 / 8 (62.5%)	3 / 5 (60.0%)	1 / 2 (50.0%)	1 / 6 (16.7%)
3. Patient well-being	18 / 26 (69.2%)	10 / 17 (58.8%)	4 / 4 (100.0%)	4 / 5 (80.0%)	2 / 8 (25.0%)
4. Care for staff	10 / 14 (71.4%)	8 / 10 (80.0%)	2 / 4 (50.0%)	–	1 / 4 (25.0%)
5. Pediatric post-intensive care syndrome and discharge preparation	0 / 12 (0.0%)	0 / 6 (0.0%)	0 / 3 (0.0%)	0 / 3 (0.0%)	0 / 12 (0.0%)
6. Care at end of life	18 / 22 (81.8%)	13 / 17 (76.5%)	4 / 4 (100.0%)	1 / 1 (100.0%)	0 / 4 (0.0%)
7. Infrastructure	20 / 23 (87.0%)	15 / 16 (93.8%)	3 / 3 (100.0%)	2 / 4 (50.0%)	0 / 3 (0.0%)
Overall total	88 / 132 (66.7%)	57 / 84 (67.9%)	22 / 31 (71.0%)	9 / 17 (52.9%)	5 / 44 (11.4%)

Note. Values are expressed as the number of implemented items / total items (%). Basic, advanced, and excellent refer to the complexity levels defined in the Manual to guide progressive implementation. Five items identified as "in progress" at baseline were excluded from the subsequent comparative analysis (Table 6) to avoid attributing pre-existing improvement efforts to changes observed during the A&F cycle.

The analysis by strategic line identified Line 7. Infrastructure (87.0%) and Line 6. Care at end of life (81.8%) as the lines with the highest compliance, while Line 5. Pediatric post-intensive care syndrome and discharge preparation showed no implementation (0%). Regarding the level of complexity, advanced practices showed the highest compliance rate (71.0%), followed by basic ones (67.9%), and excellent ones (52.9%) (Table 3).

We organized the 39 items categorized as "not implemented" according to the nature of the main resource required. The results showed that 87.2% of the practices required organizational management and training actions, while the remaining 12.8% required direct financial investment in infrastructure or equipment (Table 4).

Phases 2 and 3: Prioritization and implementation activities

In the prioritization phase (phase 2), participants selected six target practices found in Line 2. Communication (2.1, 2.9, 2.12), Line 3. Patient well-being (3.10, 3.24), and Line 5. Pediatric post-intensive care

Table 4
Qualitative characterization of implementation gaps by main limiting resource.

Type of resource	Number of items	% of total	Complexity level		
			Basic	Advanced	Excellent
Multidisciplinary management	17	43.6%	13	4	–
Training	7	17.9%	3	3	1
Nursing management	6	15.4%	4	1	1
Direct financial investment	5	12.8%	2	–	3
Coordination of other services	4	10.3%	–	–	4
Total	39	100.0%	22	8	9

Note. The 39 non-implemented practices were classified according to the primary resource required for their implementation. Basic, advanced, and excellent refer to the complexity levels defined in the Manual.

syndrome and discharge preparation (5.2). The six practices are outlined in Table 5.

At the end of the implementation period (phase 3), four of the six selected practices had been formalized or implemented, corresponding to 66.7% of the prioritized practices. The actions linked to Line 2. Communication included the formalization of care protocols and training sessions; those linked to Line 3. Patient well-being involved the development of care protocols. Training in non-technical skills (2.9) was rescheduled for the first quarter of 2026 to enable coordination with the teaching department. Work on PICS-p (5.2) led to a proposal for an institutional monitoring program, which is currently being evaluated by the hospital's management team (Table 5).

Phase 4. Final evaluation results

The final evaluation (December 2025) recorded overall compliance of 72.4% (92/127; 95% CI: 64.1–79.5), compared to 69.3% (88/127; 95% CI: 60.8–76.6) at baseline, with Δ = +3.1 pp. (95% CI: –7.9 to +14.2). The overlap between the confidence intervals at both time points indicates that this change cannot be distinguished from sampling variability.

The stratified analysis by strategic line revealed changes in the prioritized areas. Line 2. Communication increased from 64.3% (9/14; 95% CI: 38.8–83.7) to 78.6% (11/14; 95% CI: 52.4–92.4), Δ = +14.3 pp. (95% CI: –18.3 to +43.3), while Line 3. Patient well-being rose from

Table 5
Implementation status of prioritized practices.

Strategic line	Code and good practice	Implementation strategy	Status (December 2025)
L2. Communication	2.1 (basic) . Structured protocol for information transfer during shift changes and with on-call staff	Protocol: standardized clinical information transfer tool	Implemented
	2.9 (advanced) . Training in non-technical skills, difficult news communication, bereavement, and emotional support	Training: non-technical skills course on bad news communication and emotional management	Scheduled for Q1 2026
	2.12 (excellent) . Training for professionals, patients, and families in the use of AACSS	Training: AACSS sessions with pictograms and digital tools	Implemented
L3. Patient well-being	3.10 (basic) . Protocol integrating the family into hygiene, hydration, and injury prevention care	Protocol: visual guide for family participation in basic care	Implemented
	3.24 (basic) . Night-rest protocol involving patients, families, and professionals	Protocol: quiet hours and care clustering	Implemented
L5. PICS-p and discharge preparation	5.2 (basic) . PICU staff training on PICS-p and its prevention	Training: basic PICS-p course	Institutional program proposal under consideration

Note. AACSS = augmentative and alternative communication systems; PICU = pediatric intensive care unit; PICS-p = pediatric post-intensive care syndrome.

75.0% (18/24; 95% CI: 55.1–88.0) to 83.3% (20/24; 95% CI: 64.1–93.3), Δ = +8.3 pp. (95% CI: –14.9 to +30.6). In both cases, the wide confidence intervals reflect the limited number of items per strategic line and show substantial overlap between baseline and final evaluation. When aggregating the three prioritized strategic lines (Line 2. Communication, Line 3. Patient well-being, and Line 5. Pediatric post-intensive care syndrome and discharge preparation), compliance increased from 54.0% (27/50; 95% CI: 40.4–67.0) to 62.0% (31/50; 95% CI: 48.2–74.1), Δ = +8.0 pp. (95% CI: –11.0 to +26.2), whereas the non-prioritized lines remained stable at 79.2% (61/77; 95% CI: 68.9–86.8), Δ = 0.0 pp. (95% CI: –12.8 to +12.8) (Table 6).

Regarding Line 5 (Pediatric post-intensive care syndrome and discharge preparation), the quantitative indicator remained at 0% (0/12; 95% CI: 0.0–24.2), consistent with the reorientation of the project towards an institutional program currently pending approval.

Overall, the number of practices categorized as 'not implemented' decreased from 39 to 35 between the baseline audit and the final evaluation.

Discussion

This study describes the first experience of implementing the *Manual of Good Practices in Humanization in Pediatric Intensive Care Units* through an A&F strategy. Consistent with its observational design, the study should be interpreted as an implementation-focused quality improvement study rather than as an evaluation of intervention effectiveness. The overall increase in compliance was modest, with a gain of 3.1 percentage points over the 12-month cycle, and the overlap between pre- and post-evaluation confidence intervals indicates statistical uncertainty regarding the magnitude of this change. However, statistical uncertainty and practical relevance address different aspects of the findings. Although the aggregate quantitative change cannot be considered evidence of effectiveness, the A&F cycle generated concrete organizational outputs, including care protocols, training materials, and the escalation of a PICS-p follow-up proposal for institutional evaluation.

The practical significance of the observed change lies less in the magnitude of the aggregate compliance increase and more in the type of practices consolidated during the cycle. In the Manual, each practice contributes equally to the overall compliance score, which facilitates transparency and reproducibility but does not capture differences in clinical importance, complexity, resource requirements, or relevance to patients and families. Therefore, the aggregate percentage should be interpreted alongside the nature of the specific practices implemented. The four formalized practices addressed clinically meaningful care processes: structured information transfer between shifts, a

Table 6
Pre-final evaluation comparison of compliance by strategic line.

Strategic line	Total items	Baseline audit		Final evaluation		Δ (pp)
		N (%)	95% CI	N (%)	95% CI	
L1. PICU open doors and family participation in care	19	13 (68.4)	[46.0–84.6]	13 (68.4)	[46.0–84.6]	0.0
L2. Communication ^a	14	9 (64.3)	[38.8–83.7]	11 (78.6)	[52.4–92.4]	+14.3
L3. Patient well-being ^a	24	18 (75.0)	[55.1–88.0]	20 (83.3)	[64.1–93.3]	+8.3
L4. Care for staff	13	10 (76.9)	[49.7–91.8]	10 (76.9)	[49.7–91.8]	0.0
L5. PICS-p and discharge preparation ^a	12	0 (0.0)	[0.0–24.2]	0 (0.0) ^b	[0.0–24.2]	0.0
L6. Care at end of life	22	18 (81.8)	[61.5–92.7]	18 (81.8)	[61.5–92.7]	0.0
L7. Infrastructure	23	20 (87.0)	[67.9–95.5]	20 (87.0)	[67.9–95.5]	0.0
Overall total	127^c	88 (69.3)	[60.8–76.6]	92 (72.4)	[64.1–79.5]	+3.1

Note. Δ (pp) = absolute change expressed in percentage points, calculated as final evaluation minus baseline audit; CI = confidence interval; PICU = pediatric intensive care unit; PICS-p = pediatric post-intensive care syndrome. Confidence intervals were calculated using the Wilson score method.

^a Prioritized strategic lines.

^b The practice prioritized in this line led to a proposal for an institutional program pending approval and was not counted as implemented in the final quantitative indicator.

^c Five practices already undergoing active improvement before the baseline audit were excluded from the comparative analysis to avoid attributing pre-existing improvement efforts to changes observed during the A&F cycle. These exclusions were distributed as follows: Line 1 (n = 1), Line 2 (n = 1), Line 3 (n = 2), and Line 4 (n = 1).

known risk area for information loss and adverse events (McCarthy et al., 2025); communication with non-verbal patients through augmentative and alternative communication strategies (Zaylskie et al., 2024); family participation in basic care, which may help reduce parental stress and support PICS-p prevention (Davidson et al., 2017; Williams et al., 2025); and care clustering to promote rest, targeting sleep disruption, delirium risk, and the need for deep sedation in critically ill children (Hassinger et al., 2023; Smith et al., 2022). Although these practices may support safer and more family-centered care, the study did not measure patient- or family-level outcomes; therefore, their clinical impact remains to be evaluated in future A&F cycles.

The baseline evaluation revealed a counterintuitive implementation profile: compliance with advanced practices (71.0%) exceeded that of basic ones (67.9%). This finding may reflect the “technological imperative” described in critical care, whereby pressure for technical effectiveness can displace fundamental relational needs such as communication and environmental well-being (Nielsen et al., 2023). In our unit, this dynamic was illustrated by the absence of a standardized clinical information transfer protocol (practice 2.1), a basic communication practice that was prioritized because it had been displaced by high-acuity workflows. This observation is consistent with evidence that communicative and relational aspects of nursing care are frequently omitted under conditions of high workload in intensive care settings (Yang et al., 2025), despite being identified by families as relevant to PICU safety and quality (Charles et al., 2026). The A&F cycle sought to address this imbalance by prioritizing four basic-level practices, aiming to ensure that fundamental care accompanies technical excellence according to the high-tech/high-touch model (Borges do Nascimento et al., 2023; Gangl & Krychtiuk, 2023).

The changes observed in the prioritized areas should be interpreted from an implementation science perspective rather than as evidence of effectiveness. The participatory prioritization phase sought to foster ownership, adoption, and contextual fit by giving the team decision-making capacity over the selected practices (Gagnon et al., 2024). Feasibility was supported by the use of existing organizational resources, while sustainability was promoted by integrating the resulting protocols into the unit’s protocol catalog and incorporating pending training into the annual teaching plan. These findings are consistent with implementation science principles suggesting that bottom-up strategies may favor cultural sustainability compared with top-down approaches (Gagnon et al., 2024; Ramanadhan et al., 2024).

The analysis of practices pending consolidation reveals the diagnostic capacity of the *Manual* to identify needs that exceed the unit’s autonomous capacity. Line 5, focused on PICS-p and discharge preparation, remained at 0% because establishing outpatient follow-up pathways and primary care coordination required interdepartmental clinical pathways, protected staff time, and hospital management approval. Rather than adopting superficial measures, the team escalated the initiative to an institutional proposal (Barnden et al., 2023; Minkman et al., 2025; Tracy et al., 2025). This is consistent with the limited formalization of post-PICU follow-up internationally, where multidisciplinary programs integrated into routine care remain uncommon (Micaëlli et al., 2025; Quadir et al., 2024). Advanced practice nurses, in collaboration with PICU bedside nurses, may be well positioned to lead the coordination of PICS-p screening at discharge, family education, and structured referral to specialist services (Dervan et al., 2025; Micaëlli et al., 2025).

From an implementation perspective, sustainability was considered a central objective of the first A&F cycle. Three mechanisms may support the maintenance of the organizational outputs generated: incorporation of new protocols into the unit’s protocol catalog, integration of pending non-technical skills training into the annual teaching plan, and use of the *Manual* as a periodic re-auditing tool. The predominance of organizational over financial barriers (87.2% vs. 12.8%) suggests that, in this context and once structural minimums are met, progress in humanization may depend largely on clinical leadership, management capacity, and contextual adaptation rather than on budgetary constraints alone. The low frequency of architectural barriers in this unit may partly reflect its relative modernity (inaugurated in 2011), as the original design already incorporated evidence-based criteria such as individual rooms and climate control (Kirk Hamilton & Shepley, 2010). In this experience, key management actions included protected time for working group meetings, designation of leads for each strategic line, integration of humanization objectives into the unit’s quality plan, and negotiation with the nursing directorate to incorporate training into the institutional teaching plan.

Limitations

The results must be interpreted considering the limitations inherent in the observational design. The absence of an external control group precludes ruling out confounding factors or temporal trends; therefore,

the documented changes should be interpreted as changes over time within a real-world clinical setting rather than as evidence of intervention effectiveness.

The study focused on organizational and process indicators derived from the Manual and did not include patient- or family-level outcomes. This limits the clinical interpretability of the findings, as it cannot be determined whether the organizational changes observed translated into improvements in child comfort, family stress, satisfaction, communication experience, or PICS-p-related outcomes. Future A&F cycles should incorporate patient- and family-reported outcomes to assess whether changes in humanization practices translate into meaningful benefits for children and families.

Evaluator blinding was not applicable in this audit-based design, and the involvement of the same team in both implementation and evaluation may have introduced observer and confirmation bias. The most likely direction of this bias would be an overestimation of compliance at the final evaluation, particularly for practices requiring interpretive judgment or supported by recently developed documentation. To mitigate this risk, the evaluation prioritized objective documentary evidence and consensus resolution of discrepancies. Finally, as the study was conducted in a single, highly specialized, and relatively well-resourced PICU, applicability to lower-resource settings should be interpreted cautiously. Units with fewer human, structural, educational, or institutional resources may face different implementation barriers, although the A&F cycle and standardized protocols may be adapted according to local priorities and contextual constraints.

Conclusions

This implementation-focused quality improvement study suggests that an A&F strategy using the *Manual of Good Practices in Humanization in Pediatric Intensive Care Units* may be feasible for structuring the monitoring, prioritization, and adoption of humanization practices in a high-complexity PICU. Over the 12-month cycle, modest quantitative changes in compliance and concrete organizational outputs were observed, including the formalization of care protocols, the development of training materials, and the submission of an institutional proposal. However, the small overall increase in compliance and the overlap between confidence intervals indicate that these findings should be interpreted cautiously and cannot be considered evidence of intervention effectiveness. The analysis of implementation barriers showed that most unimplemented practices depended on organizational and training factors rather than on financial investment, suggesting that progress in humanization may depend largely on clinical leadership, management capacity, and contextual adaptation. The baseline compliance profile, in which practices of greater technical complexity showed higher compliance than basic ones, suggests that humanization requires explicit planning to be consolidated alongside technical excellence in pediatric intensive care. Future A&F cycles should incorporate external independent auditors, assess sustainability over time, and include patient- and family-level outcomes to determine whether organizational changes translate into meaningful benefits for children and families.

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CRediT authorship contribution statement

Javier García-Fernández: Writing – original draft, Visualization, Resources, Project administration, Investigation, Funding acquisition, Data

curation. **Pilar Delgado-Hito:** Writing – review & editing, Visualization, Supervision, Project administration, Investigation, Conceptualization. **Vanessa Segura-Encinas:** Investigation. **Noemi Rosell-Ruiz:** Investigation. **Marta Romero-García:** 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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