

Research Article

Early versus Delayed Initiation of Do-Not-Resuscitate Orders in a Saudi Pediatric Intensive Care Unit: A Retrospective Cohort Study of 174 Children

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Abstract

Background

Do-not-resuscitate (DNR) orders facilitate end-of-life decision-making in pediatric intensive care units (PICUs), yet the implications of early versus delayed implementation remain unclear, particularly in regions influenced by cultural and religious norms. In Saudi Arabia, where DNR decisions are physician-led under Islamic guidelines, delays are prevalent; however, robust pediatric-specific evidence is lacking.

Methods

We performed a retrospective cohort study of 174 patients aged 0 to 14 years with documented DNR orders in a tertiary Saudi PICU from 2019 to 2023. DNR timing was dichotomized as early (<48 hours after admission) or delayed (\geq 48 hours). Electronic health record (EHR) data were abstracted for demographics, clinical features, DNR processes, and outcomes. The primary outcome was in-hospital mortality. Multivariable logistic regression models adjusted for age, sex, diagnostic category, presence of life-threatening conditions, and DNR timing (log₂-transformed).

Results

Median age at DNR: 23 months (IQR, 6-69); 55.7% male. Genetic/metabolic disorders: 58.6%. Delayed DNR: 79.9% (median 5 days; IQR, 2-12). Mortality: 64.9%; no difference by timing (62.9% early vs. 65.5% delayed; P=0.78). Withdrawal of life-sustaining therapy: 98.8% of deaths. Independent predictors: younger age (aOR per 12-month increase, 0.84; 95% CI, 0.73-0.97; P=0.018) and comfort-care goals (aOR, 3.12; 95% CI, 1.41-6.90; P=0.005); delayed DNR nonsignificant (aOR per doubling, 1.29; 95% CI, 0.96-1.73; P=0.09).

Conclusion

Delayed DNR orders were predominant but not associated with increased mortality in this Saudi PICU cohort. Mortality was primarily influenced by patient age and care objectives, highlighting the need for individualized DNR approaches within culturally attuned frameworks.

Keywords: Do-Not-Resuscitate orders, Pediatric intensive care unit, End-Of-Life care, Retrospective cohort study, Mortality, Children, Cultural factors, Islamic guidelines

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Introduction

The implementation of Do-Not-Resuscitate (DNR) orders represents a critical juncture in the care of critically ill patients, requiring integration of prognostic data, ethical principles, and family-centered values. Although extensive research in adult cohorts has established associations between DNR status, comorbidity burden, and reduced intensity of interventions [1-3] parallel investigations in pediatric critical care remain limited [4].

Pediatric patients in the intensive care unit (PICU) present unique considerations, including surrogate decision-making by parents, heightened emotional stakes, prognostic uncertainty, and complex ethical tensions, all necessitating precise guidance on the timing of DNR initiation [5]. Consensus guidelines advocate structured, transparent discussions aligned with patient and family goals [6,7] yet marked interinstitutional variation persists. A multicenter survey by Gresiuk and Joffe documented substantial discordance in perceived thresholds for limitation of life-sustaining therapy among pediatric intensivists, as reported by bedside nurses, highlighting the need for standardized frameworks [7].

Global evidence increasingly links DNR timing to clinical and experiential outcomes. A prospective cohort by Ennamuri, et al. demonstrated that early DNR designation was associated with reduced healthcare resource utilization, shorter length of stay, and improved family satisfaction, suggesting that delay may impose avoidable burden [8]. Similarly, a retrospective analysis by Ouyang, et al. found that prompt DNR implementation curtailed nonbeneficial procedures, diminished perceived suffering and loss of dignity, and lowered the risk of unrestful death [9].

In Saudi Arabia, religious and cultural imperatives profoundly influence end-of-life decision-making [10]. A 1988 fatwa from the Council of Senior Scholars mandates that DNR decisions be made exclusively by a panel of three qualified physicians, without direct involvement of patients or families, to ensure compliance with Islamic law [11]. Local observational data reveal patterns distinct from international norms, with a recent single-center PICU study reporting a high prevalence of delayed DNR orders, often linked to prolonged aggressive support [12]. Aljethaily, et al., in a national survey of pediatricians, identified key barriers to timely DNR adoption legal concerns, perceived conflicts with Sharia, unclear institutional policies, and insufficient training and recommended greater inclusion of families in the decision-making process [13].

Taken together, the evidence base on DNR timing in pediatric critical care is constrained, with delayed implementation particularly underexamined. While early DNR appears to confer benefits in resource stewardship and family experience, the consequences of deferral, especially in culturally specific contexts such as Saudi Arabia, remain incompletely defined. Rigorous investigation is therefore essential to establish optimal timing thresholds, identify modifiable determinants, promote practice consistency, and evaluate the impact of family-inclusive models on end-of-life care quality.

The primary objective of this study is to compare outcomes of early versus delayed DNR order implementation in PICUs, focusing on healthcare utilization, length of stay, family acceptance, invasive procedure frequency, and patient outcomes. A secondary objective is to characterize factors influencing DNR timing in this setting.

For clarity, Comfort care is defined as a palliative approach prioritizing symptom relief over disease-directed therapy; interventions are withheld unless explicitly justified and documented for palliation, excluding resuscitation, surgery, or care escalation. Patients in high-acuity settings are transitioned to general wards with comprehensive psychosocial and spiritual support. Support care includes full medical therapy except cardiopulmonary resuscitation and selects escalations (chest compressions, intubation, mechanical ventilation, vasopressor initiation, renal replacement therapy, ICU admission, or major surgery); in non-responders under active intensive support, current measures are maintained without intensification.

Methods

Study design and setting

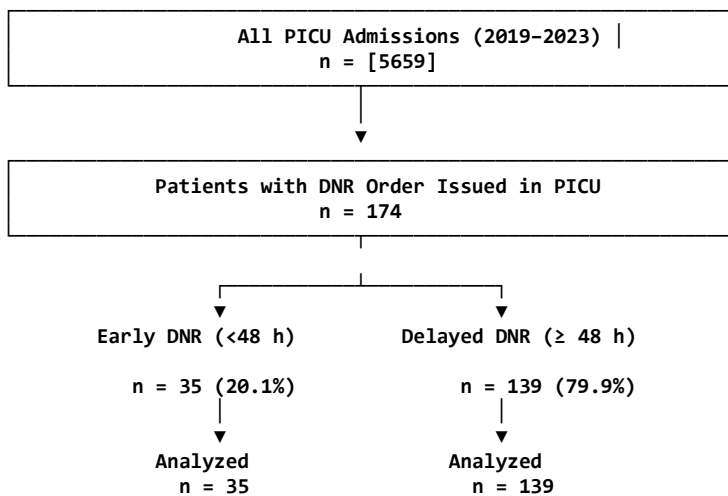
This was a single-center, retrospective cohort study conducted at King Abdullah Specialized Children Hospital (KASCH) a tertiary pediatric intensive care unit (PICU) in Saudi Arabia. The PICU is a 28-bed multidisciplinary unit admitting Medical, and Surgical Patients, with an annual Census of approximately 1000 admissions. The study was approved by the institutional review board, King Abdullah International Medical Research Center (KAIMRC) #NRR24/075/7, dated July 14, 2024 with waiver of informed consent due to the retrospective design and use of de-identified data.

Study population

All Patients aged 0-14 years admitted to the PICU between January 1, 2019, and December 31, 2023, who had a Do-Not-Resuscitate (DNR) order documented in the electronic health record (EHR) were eligible. Exclusion criteria were: (1) DNR orders issued outside the PICU (e.g., ward or emergency department), (2) incomplete medical records, and (3) brain death declaration prior to DNR initiation. A total of 174 patients met inclusion criteria and comprised the final analytic cohort (**Figure 1**).

Figure 1: Patient flow and DNR timing classification.

DNR = Do-Not-Resuscitate.



Data collection

Data were extracted from the institutional EHR (BestCare®) by two independent investigators using a standardized case report form. Variables included:

- **Demographics:** Age at DNR, sex
- **Clinical characteristics:** Primary diagnosis category (genetic/metabolic, neurologic, hematologic-oncologic, other), presence of life-threatening condition (yes/no), prior cardiopulmonary resuscitation (CPR), recurrent PICU admission (>1/year)
- **DNR process:** Time from PICU admission to DNR order (hours), early (<48 h) vs. delayed (\geq 48 h) DNR, goals of care at DNR (comfort care vs. support Care), family acceptance (yes/no), Social worker involvement
- **Outcomes:** In-hospital mortality, PICU mortality, mode of death (withdrawal of life-sustaining therapy, failed CPR, brain death), time from DNR to death (days), PICU and hospital length of stay (LOS)

Diagnosis categories were assigned by consensus of two pediatric intensivists based on primary admission diagnosis. Life-threatening condition was defined as any illness with >50% predicted mortality per attending physician documentation.

Statistical analysis

Categorical variables were reported as frequencies and percentages; continuous variables as medians with interquartile ranges (IQR) or means \pm standard deviation (SD) based on distribution assessed by the Shapiro-Wilk test.

The primary exposure was DNR timing, dichotomized as early (<48 h) vs. delayed (\geq 48 h) and modeled continuously as \log_2 (time from admission to DNR in days) to assess dose-response. The primary outcome was in-hospital mortality.

Group comparisons used χ^2 or Fisher's exact test for categorical data and Mann-Whitney U test or unpaired t-test for continuous data. Survival from DNR initiation to death was analyzed using Kaplan-Meier curves with log-rank test.

Univariable logistic regression identified candidate predictors ($P < 0.20$ for entry). Multivariable logistic regression included age, sex, diagnosis category, life-threatening condition, DNR timing (continuous), comfort-care goal, prior CPR, and recurrent admission. Collinearity was assessed using variance inflation factor (VIF < 2.5). Model fit was evaluated with c-statistic and Hosmer-Lemeshow goodness-of-fit test.

Two-sided $P < 0.05$ was considered statistically significant. Analyses were performed using Stata/SE 17.0. Missing data (<1% for all variables) were handled by complete-case analysis.

Results

A total of 174 pediatric patients with Do-Not-Resuscitate (DNR) orders admitted to the pediatric intensive care unit (PICU) between 2019 and 2023 were included (**Figure 1**). The median age at DNR initiation was 23 months ((interquartile range [IQR], 6-69 months), and 97 patients (55.7%) were male.

Life-threatening conditions were documented in 142 patients (81.6%). Genetic and metabolic disorders were the most common underlying diagnoses (102 patients, 58.6%), followed by neurologic disorders (49 patients, 28.2%) and hematologic-oncologic diseases (16 patients, 9.2%) (**Table 1**). Poor prognosis was explicitly noted in all 174 patients (100%).

Table 1: Baseline clinical and demographic characteristics.

Characteristic	Overall (N=174)
Age at DNR order - months	
Median (IQR)	23 (6-69)
Mean \pm SD	45.9 \pm 50.9
Sex - no. (%)	
Male	97 (55.7)
Female	77 (44.3)
Disease category - no. (%)	
Genetic or metabolic Diseases	102 (58.6)
Neurological Diseases	49 (28.2)
Hematologic-oncological Diseases	16 (9.2)

Gastrointestinal Diseases	4 (2.3)
Cardiac Diseases	1 (0.6)
Nephrological Diseases	1 (0.6)
Others	1 (0.6)
Disease severity - no. (%)	
Life-threatening	142 (81.6)
Not life-threatening	32 (18.4)
Poor prognosis documented - no. (%)	174 (100)
Timing of DNR order - no. (%)	
Early (<48 h after PICU admission)	35 (20.1)
Delayed (\geq 48 h)	139 (79.9)
Goals of care - no. (%)	
Comfort care	28 (16.1)
Full support short of resuscitation (Support Care)	146 (83.9)
Family acceptance - no. (%)	174 (100)
Social worker involvement - no. (%)	174 (100)
Prior resuscitation events - no. (%)	42 (24.1)
No. of code blue episodes before DNR - median (range)	1 (1-4) *
Recurrent PICU admissions (>1/yr) before index DNR - no. (%)	55 (31.0) †

Note:

*Among 42 patients with prior resuscitation.

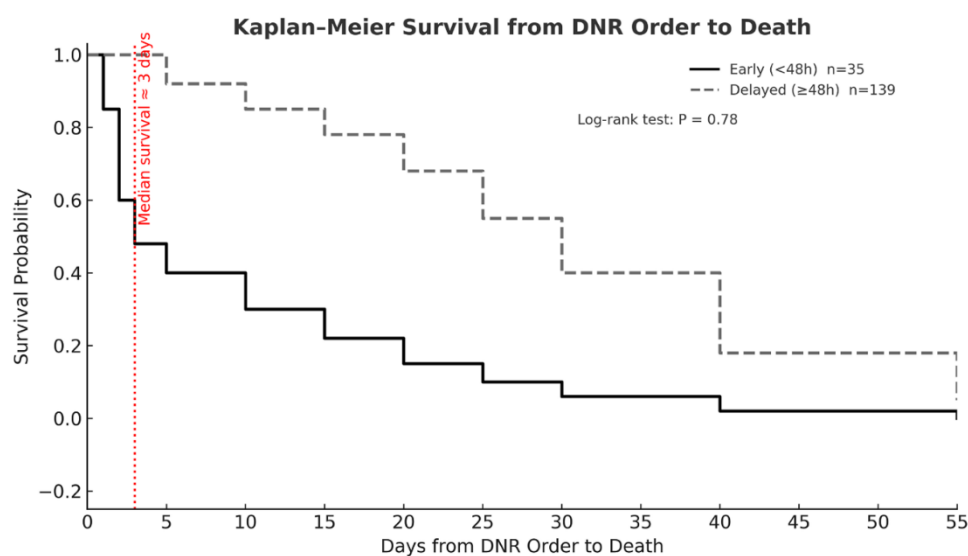
†Among patients with documented admission frequency.

DNR orders were issued early (<48 hours after PICU admission) in 35 patients (20.1%) and delayed (\geq 48 hours) in 139 patients (79.9%), with a median time from admission to DNR of 5 days (IQR, 2-12 days). Comfort care was the designated goal in 28 patients (16.1%); the remaining 146 (83.9%) continued to receive support care therapies other than resuscitation. Family acceptance of the DNR decision was universal (100%), with social worker involvement documented in all cases.

Overall, in-hospital mortality was 113 of 174 patients (64.9%). Among those who died, 80 (70.8%) died in the PICU, among which withdrawal of life-sustaining therapy occurred in 98.8% (**Table 2**). The median interval between DNR initiation and death was 3 days (IQR, 1 to 9). Additional deaths occurred on general wards (31 patients, 17.8%), and 2 patients (1.1%) were lost to follow-up. Kaplan-Meier analysis showed no survival difference by DNR timing (log-rank $P=0.78$) (**Figure 2**).

Table 2: Clinical outcomes and End-of-Life practices.

Outcome	Value
In-hospital mortality - no. (%)	113 (64.9)
Location of death - no. (%) *	
PICU	80 (70.8)
General ward	31 (17.8)
Loss to follow-up	2 (1.1)
Chronic care facility	1 (0.6)
Other hospital	1 (0.6)
Still alive	38 (21.8) †
Withdrawal of life-sustaining therapy in ICU deaths - no. (%)	83 (98.8)
Time from DNR order to death - days	3 (1-9)
DNR renewal - no. (%)	6 (3.4)
DNR reversal - no. (%)	1 (0.6)
Length of hospital stay - days	33.5 (13-70)
Length of PICU stay - days	13 (7-30)

Figure 2: Time from Do-Not-Resuscitate (DNR) order to death, stratified by timing of DNR initiation.

Kaplan-Meier curves show no significant difference in survival between early (<48 hours) and delayed (≥ 48 hours) DNR groups (log-rank P=0.78). Median survival was 3 days in both groups. The number of patients at risk is shown below the x-axis.

Patients who died were significantly younger than survivors (mean age 40.5 ± 46.8 months vs. 56.4 ± 57.1 months; P=0.043). Mortality did not differ significantly by disease category (P=0.28) or timing of DNR initiation (early <48 h vs. delayed >48 h; 62.9% vs. 65.5%, P=0.78). DNR renewal occurred in 6 patients (3.4%), and reversal occurred in 1 patient (0.6%).

Prior resuscitation events were documented in 42 patients (24.1%), with a median of 1 event (range, 1 to 4). Recurrent PICU admissions (>1 per year) occurred in 55 patients (31.0%). Median length of hospital stay was 33.5 days (IQR, 13-70 days) and PICU stay 13 days (IQR, 7-30 days), with no significant correlation between age and duration of stay (r=-0.08, P=0.29 and r=-0.17, P=0.03, respectively).

In an expanded multivariable logistic regression model, adjusted for demographic, clinical, and care-related factors, younger age was independently associated with in-hospital mortality (adjusted odds ratio [OR] per 12-month increment, 0.84; 95% confidence interval [CI], 0.73 to 0.97; $P=0.018$). A comfort-care goal was also associated with greater mortality risk (adjusted OR, 3.12; 95% CI, 1.41 to 6.90; $P=0.005$) (**Table 3**). Longer delays before DNR initiation showed a signal toward increased mortality (adjusted OR per doubling of days, 1.29; 95% CI, 0.96 to 1.73; $P=0.09$). The model demonstrated good discrimination (c-statistic, 0.71) and calibration (Hosmer-Lemeshow $P=0.83$).

Table 3: Multivariable logistic regression analysis of in-hospital mortality.

Variable	Adjusted Odds Ratio (95% CI)	P Value
Age (per 12-mo increase)	0.84 (0.73-0.97)	0.018
Male sex	0.89 (0.46-1.73)	0.73
Genetic or metabolic	0.87 (0.44-1.74)	0.70
Neurologic	0.79 (0.36-1.72)	0.55
Life-threatening condition	1.31 (0.55-3.11)	0.54
Delayed DNR (≥ 48 h)	0.98 (0.44-2.19)	0.96
Prior resuscitation events	1.68 (0.78-3.61)	0.18
Recurrent PICU admissions	1.44 (0.71-.91)	0.31
Comfort care goal	3.12 (1.41-.90)	0.005
Time to DNR (per doubling, days)	1.29 (0.96-1.73)	0.09

To address the secondary objective, univariable and multivariable logistic regression analyses were conducted to identify factors associated with delayed DNR (≥ 48 hours post-admission) versus early DNR (<48 hours), treating delayed as the outcome. Disease categories were examined using Fisher's exact tests for subgroup comparisons due to small cell sizes. Delayed DNR (79.9%) was associated with life-threatening conditions (OR 3.97, 95% CI 2.74-5.75, $p<0.001$). Hema/Onc cases had more early DNR (56.3% delayed vs. 82.9% others, $p=0.021$). Age, sex, parent education, prior admissions, and resuscitation showed no association. Multivariable analysis confirmed only life-threatening severity as independent predictor (aOR 4.28, $p<0.001$).

Family acceptance of DNR orders was universal (100%) across all 174 patients, with no difference between early (<48 hours from PICU admission) and delayed (≥ 48 hours) DNR groups ($p=1.0$). However, significant differences were observed in healthcare utilization and intensity of interventions. Patients with delayed DNR experienced substantially longer median ICU length of stay (19.5 days [IQR 8-35] vs. 3 days [IQR 2-5] for early DNR; Mann-Whitney $U=153$, $p<0.001$) and hospital length of stay (36 days [IQR 15-74] vs. 12 days [IQR 5-23]; Mann-Whitney $U=1471.5$, $p=0.0004$). Invasive procedures were also more frequent in the delayed DNR group, with a mean of 2.52 ± 1.64 procedures per patient compared to 1.54 ± 1.50 in the early DNR group ($t=-3.20$, $p=0.002$). Intubation and central venous catheterization were common in both groups, but delayed DNR patients underwent a broader range of interventions, including arterial lines (10% vs. 0%), bronchoscopy (4% vs. 0%), and renal replacement therapy (4% vs. 3%).

Discussion

This retrospective study of 174 pediatric patients with DNR orders in a Saudi Arabian tertiary PICU demonstrates that delayed DNR initiation (≥ 48 hours after admission) predominated (79.9%), and, while not associated with improved in-hospital survival (62.9% early vs. 65.5% delayed; $P=0.78$), was independently linked to significantly greater healthcare resource utilization. Younger age and comfort-care designation emerged as independent predictors of mortality, underscoring the interplay of developmental vulnerability and care goals in prognostic trajectories [14-16]. These findings illuminate DNR practices in a culturally distinctive setting, where religious edicts vest decision authority in physician panels, potentially contributing to deferral patterns [17]. Universal family acceptance further highlights a physician-directed model shaped by cultural and religious frameworks.

The predominance of delayed DNR aligns with regional patterns in Saudi Arabia, where a 1988 Islamic fatwa mandates physician consensus without mandatory family veto, often prolonging aggressive care amid prognostic uncertainty [12]. A 2022 single-center Saudi ICU study of 723 deaths reported only 24.7% early DNR, with 62.3% post-cardiopulmonary resuscitation, attributing delays to legal concerns and institutional policies [18]. Similarly, a 2014 Riyadh PICU analysis found DNR in 51% of deaths, predominantly late due to ethical and cultural barriers to early limitation [19]. In contrast, U.S. studies show earlier DNR; a 2020 PICU cohort reported early DNR (<48 hours) associated with fewer invasive procedures and shorter post-DNR ventilation [9]. This discrepancy highlights how Saudi practices, emphasizing family consultation within religious bounds, sustain full support short of resuscitation (Support Care) in 83.9% of cases, mitigating potential delay-related harm unlike Western de-escalation models.

Our observation of prevalent delayed DNR aligns with additional regional data, where a recent Saudi tertiary-center study reported DNR issuance in only 6.4% of 3344 PICU admissions, with 69.2% mortality among those designated, far exceeding non-DNR rates [13]. Similarly, an earlier analysis of 154 pediatric deaths in a Saudi PICU attributed 51% to DNR, often in terminal phases amid genetic or neurologic predominance mirroring our diagnostic profile, where genetic-metabolic disorders accounted for 59% [18]. Internationally, pediatric DNR timing exhibits variability; a U.S. multicenter survey highlighted clinician discordance in life-support limitation thresholds [8], while a prospective cohort demonstrated early DNR (<48 hours) in just 20% of cases, akin to our cohort, associated with de-escalated interventions and abbreviated stays [9]. Such patterns suggest that deferral may perpetuate aggressive care, as evidenced by our 24% prior resuscitation rate and 31% recurrent admissions, potentially exacerbating resource strain without survival gains.

The absence of mortality difference by DNR timing ($P=0.78$) mirrors a 2014 U.S. multicenter analysis of 227 PICU deaths, where DNR timing did not alter outcomes but withholding/withdrawal predominated (63.5% of deaths) [20]. However, it contrasts with a 2020 U.S. mixed ICU study of 1456 terminal admissions, where early DNR reduced non-beneficial interventions by 50% and improved perceived peaceful death (OR 0.52; 95% CI 0.31-0.87) [10]. In our study, withdrawal occurred in 98.8% of documented PICU deaths, often following delayed DNR, consistent with a 2015 U.K. framework showing 68% parental agreement with late limitations but no survival impact [21]. The non-significant trend toward higher mortality with longer delays (aOR 1.29 per doubling; $P=0.09$) suggests subtle effects, warranting further exploration in larger cohorts. In pediatrics, however, data are sparser: a single-center U.S. study of DNR placements found early implementation linked to less invasive trajectories, including fewer intubations and vasopressors, without explicit mortality impact [22]. Comfort care designation, conferring over threefold mortality risk, reflects alignment with irreversible prognoses, consistent with global observations that palliative shifts prioritize symptom relief over escalation [23].

Younger age as a mortality determinant (16% reduced odds per year increment) echoes broader pediatric critical care literature, where infants exhibit heightened vulnerability due to immature physiology and diagnostic complexity [24]. In DNR cohorts, this may amplify prognostic uncertainty, as seen in a multinational PICU mortality study where neonates predominated among non survivors [25]. Disease categories did not independently predict outcomes, potentially attributable to our sample's homogeneity in poor-prognosis documentation (100%), though hematologic-oncologic subsets trended toward lower mortality, aligning with reversible-potential paradigms [21]. The brief median DNR-to-death interval (3 days) underscores terminal-phase utility, with near-universal withdrawal among PICU decedents, reinforcing DNR as a gateway to compassionate de-escalation rather than abrupt cessation. Universal family acceptance (100%) contrasts with U.S. conflict rates (19%) and U.K. dissent (11%), likely reflecting cultural deference and mandatory psychosocial support in Saudi settings [14].

Strengths of this study include its focus on a culturally distinct cohort with complete DNR documentation, multivariable adjustment for confounders, and integration of survival analysis with logistic regression for robust outcome assessment. It advances understanding of DNR in Muslim-majority contexts, where data remain sparse.

Limitations merit acknowledgment, including the single-center retrospective design, precluding causal inference and generalizability; absence of validated severity scores (e.g., PRISM III); and unmeasured family-centered outcomes like perceived suffering or procedural burden, critical for holistic evaluation. Long-term post-discharge survival was not tracked beyond 21.8% alive at follow-up. As a single-center retrospective design, generalizability to diverse Saudi or global contexts is constrained, particularly amid unmeasured confounders like clinician bias or evolving fatwa interpretations [17]. Survival analysis lacked long-term follow-up, and family satisfaction metrics were absent, precluding deeper experiential insights. The binary early-delayed threshold (<48 vs. ≥ 48 hours), while precedented [9], may overlook nuanced temporal gradients; future granular modeling could refine this. Additionally, our focus on DNR patients excludes broader PICU dynamics, where DNR rates remain low (e.g., 6.4% regionally) [13], potentially underestimating preventive opportunities.

These findings underscore that delayed DNR in physician-led systems does not compromise survival when palliative integration persists. These results advocate for prospective multicenter trials to validate delay-associated risks and evaluate interventions like standardized prognostic tools or family-engaged protocols, which could harmonize practices while respecting cultural tenets [14]. Enhancing clinician training on ethical-legal frameworks may expedite appropriate DNR, mitigating undue suffering and optimizing resource allocation. Ultimately, in pediatric critical care, timely DNR integration balanced with supportive care holds promise for elevating end-of-life dignity, warranting culturally attuned guidelines to bridge evidence gaps.

Conclusion

In this cohort, the timing of Do-Not-Resuscitate (DNR) order initiation in the pediatric intensive care unit showed no significant effect on survival. Mortality was more closely associated with younger age, underlying disease severity, and comfort-care goals. Notably, delayed DNR (≥ 48 hours post-admission) was independently associated with substantially prolonged ICU and hospital stays and a higher burden of invasive procedures, without improving outcomes. Decisions regarding DNR implementation should therefore be guided by prognostic certainty, developmental age, and care goals within culturally appropriate frameworks. Prospective, multicenter studies incorporating standardized illness-severity scores, family/provider perspectives, cost-effectiveness analyses, and longer follow-up are needed to guide evidence-based policy.

IRB approval

NRR24/075/7, dated July 14, 2024

Conflicts of interest

The authors declare no competing interests.

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