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Effects of a nurse-led mindfulness-based intervention on stress and emotional well-being in hospitalized school-aged children: a mixed-methods quasi-experimental study

Nourah Alsadaan^{1*} and Osama Mohamed Elsayed Ramadan^{2*}

Abstract

Aim This study aimed to evaluate the efficacy of a nurse-led mindfulness-based intervention (MBI) in reducing psychological distress and improving emotional well-being among hospitalized school-aged children.

Design A mixed-methods quasi-experimental design was used to compare the psychological outcomes of children who participated in a two-week mindfulness program with those who received standard care.

Methods A total of 60 children aged 6–12 were systematically assigned to either the intervention group ($n=30$) or the control group ($n=30$). The intervention group received daily 30-minute mindfulness sessions, while the control group received standard care. Pre- and post-intervention assessments were conducted using validated measures, including the Perceived Stress Scale for Children (PSS-C), Screen for Child Anxiety Related Emotional Disorders (SCARED), Short Mood and Feelings Questionnaire (SMFQ), and PROMIS Fatigue Scale.

Results Significant improvements were observed in the intervention group across all measures. Reductions in perceived stress (PSS-C: $p < 0.001$, $d = 1.05$), anxiety (SCARED: $p = 0.002$, $d = 0.67$), depressive symptoms (SMFQ: $p < 0.001$, $d = 0.88$), and fatigue (PROMIS: $p < 0.001$, $d = 0.94$) were reported. Qualitative feedback from children, parents, and nurses supported these findings, highlighting enhanced emotional regulation, relaxation, and coping abilities.

Conclusion The nurse-led MBI significantly improved psychological well-being, reducing stress, anxiety, and fatigue among hospitalized children. The intervention shows promise for integration into pediatric care, with high satisfaction levels from participants and healthcare providers.

Implications for the profession This study provides evidence supporting the inclusion of mindfulness-based interventions in pediatric nursing care. Due to their continuous interactions with patients, nurses are well-positioned to lead such interventions, which can enhance the emotional and physical recovery of hospitalized children.

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Keywords Nurse-led mindfulness, Psychological distress, Emotional well-being, Hospitalized children, Pediatric nursing, Mindfulness-based intervention, Stress reduction

Introduction

Hospitalization can be an emotionally challenging and stressful experience for school-aged children, often leading to adverse psychological effects such as anxiety, fear, sadness, anger, and trauma [1–3]. Hospitalized children are removed from their normal environments, daily routines, and social connections while also facing unfamiliar and unpleasant medical procedures, treatments, and the uncertainty of their health status [4–6]. This accumulated stress can negatively impact their emotional well-being and healing process [7].

Mindfulness interventions have recently emerged as low-cost and effective methods to improve mental health, resilience, and well-being in clinical and non-clinical populations [8–11]. Mindfulness involves purposefully bringing awareness to the present moment non-judgmentally [12–14]. Mindfulness-based therapies for children and youth typically include age-appropriate mindfulness meditation, yoga, art activities, or storytelling [7, 15]. A recent meta-analysis on paediatric mindfulness interventions found significant improvements in symptoms of anxiety, depression, stress, quality of life, sleep problems, and executive functioning [16]. However, research focused specifically on hospitalized school-aged children is still lacking [17–19].

The rationale behind exploring nurse-led mindfulness-based interventions in a paediatric hospital setting lies in the growing evidence supporting mindfulness as a tool for stress reduction and emotional regulation in adults [20, 21]. However, the application and effectiveness of these interventions in children, particularly hospitalized ones, are not as well understood [22–26].

Background

As primary caregivers in hospital settings, nurses are well-positioned to implement and lead such interventions, potentially enhancing their efficacy through consistent and integrated delivery [27, 28]. Nurses provide round-the-clock care, meaning they have more consistent and direct interactions with hospitalized children, allowing them to assess real-time emotional and physical needs better [29–31]. This ongoing engagement offers opportunities to seamlessly integrate mindfulness practices into daily care routines, such as during medication administration, wound care, or bedside monitoring. Additionally, nurses are often the first to recognize early signs of emotional distress, making them well-suited to deliver timely and tailored interventions that respond to children's immediate psychological states [32, 33]. By leading these interventions, nurses not only address the

mental health needs of hospitalized children but also enhance the therapeutic relationship and trust already established through their caregiving role [34]. This dual capacity as both caregivers and intervention leaders enhances the feasibility and impact of mindfulness-based therapies in pediatric hospital settings, bridging the gap between physical and emotional care [35–37].

Several studies have indicated that mindfulness practices can improve attention, reduce anxiety, and regulate emotions in children and adolescents [38–43]. Some clinical trials have shown promising results in using MBIs to help children cope with chronic pain and illness-related stress [22, 44]. However, what remains less explored is the direct impact of these interventions on hospitalized school-aged children [45, 46]. The specific challenges faced by this group, such as dealing with the uncertainty of medical conditions, separation from peers and family, and disruption of education, create a unique context for examining the efficacy of MBI [47–49].

A noticeable gap in the literature explicitly addresses the use of MBIs to reduce stress and improve emotional well-being among hospitalized school-age children [20–51]. Most existing studies focus on general paediatric populations or adults, leaving a gap in understanding how these interventions could be tailored and implemented for children in hospital settings [52–54]. Although some studies have piloted mindfulness-based therapies for hospitalized adolescents and have shown feasibility, preliminary efficacy, and high levels of satisfaction, there remains minimal research on younger school-aged children (6–12 years old) [20, 55, 56]. This is a significant gap, as this stage of development involves rapid cognitive and emotional growth, self-concept formation, increasing independence from parents, and building coping skills to deal with stress [51, 53, 57]. Mindfulness strategies can support the development of resilience during this critical period of maturation and upheaval caused by hospitalization [58, 59].

This study addresses this knowledge gap by implementing and evaluating a nurse-led, age-appropriate mindfulness-based intervention for school-aged children during hospitalization. We employ a mixed-methods quasi-experimental design to comprehensively assess the intervention's effects. The primary objective is to examine whether these interventions can effectively reduce stress and improve emotional well-being among this population. Secondary outcomes include observing impacts on symptoms of anxiety, depression, fatigue, sleep quality, and patient satisfaction.

It is hypothesized that nurse-led interventions can mitigate the accumulated stresses and uncertainty facing hospitalized children due to the relaxing effects of mindfulness in focusing awareness on the present moment. This may reduce negative emotional states and improve coping, healing, and recovery. The mixed-methods approach will allow for both quantitative measurement of outcomes and qualitative exploration of children's experiences with the intervention. Parents and hospital staff will also be surveyed to obtain additional perspectives on the efficacy and feasibility of implementing such programs.

Findings from this study will provide evidence of the benefits of nurse-led mindfulness-based therapies for improving wellness and resilience among hospitalized school-aged children. If practical, hospitals could integrate these interventions into regular paediatric care and services. This research also encourages further investigation into developmentally appropriate mindfulness-based treatments for hospitalized younger children.

This study aims to evaluate the efficacy of a nurse-led mindfulness-based intervention (MBI) in reducing psychological distress and improving emotional well-being among hospitalized school-aged children aged 6–12. It seeks to determine whether mindfulness practices can effectively mitigate stress, anxiety, depressive symptoms, and fatigue in pediatric patients during their hospital stay.

Objectives:

1. Primary Objective: To assess the impact of a nurse-led MBI on reducing perceived stress in hospitalized children (6–12 years) using the Perceived Stress Scale for Children (PSS-C).
2. Secondary Objectives:
 - Evaluate the intervention's effect on anxiety, depressive symptoms, and fatigue using validated scales (SCARED, SMFQ, PROMIS Fatigue Scale).
 - Explore children's qualitative experiences with MBI, including emotional regulation and coping strategies.
 - Assess feasibility and perceived effectiveness from parents' and healthcare providers' perspectives.

Research Hypotheses:

1. Children receiving the nurse-led MBI will show significant reductions in stress, anxiety, depressive symptoms, and fatigue compared to the control group.
2. Parents and nurses will report high levels of satisfaction regarding the intervention's

3. Qualitative data will provide additional insights into the intervention's perceived benefits and feasibility.

Methods / methodology

Design

This study employed a mixed-methods quasi-experimental design to evaluate the efficacy of a nurse-led mindfulness-based intervention for hospitalized school-aged children. The quasi-experimental approach, chosen due to ethical and logistical constraints in the hospital setting, allowed for a rigorous comparison of outcomes while acknowledging potential selection bias and confounding variables [60]. The quasi-experimental approach was necessitated by ethical and logistical constraints in the pediatric hospital setting. These constraints included (1) the imperative to maintain continuity of care, (2) ethical considerations regarding equitable intervention access, and (3) resource limitations precluding randomization across units. While this design may introduce potential selection bias, it enhances ecological validity and real-world applicability. A systematic allocation process based on admission order was employed to mitigate bias, ensuring balanced group distribution.

The quantitative arm utilized a pre-test/post-test control group design [61], with participants allocated to either an intervention group receiving a 2-week mindfulness program in addition to standard care or a control group receiving standard care alone. Outcome measures were administered at baseline (T0) and post-intervention (T1), enabling assessment of both within-group changes and between-group differences. Concurrently, the qualitative arm employed a descriptive phenomenological approach to explore the lived experiences of participants, parents, and healthcare providers, capturing rich, contextualized data to complement quantitative findings [62]. A convergent parallel mixed methods design was utilized, with quantitative and qualitative data collected simultaneously, analyzed separately, and integrated during interpretation, allowing for a comprehensive understanding of the intervention's impact by combining statistical trends with in-depth experiential data [63].

Setting

The study was conducted in the Maternity and Children Hospital paediatric ward in the northern region of the Kingdom of Saudi Arabia. This setting was chosen because it was accessible to a diverse population of school children, and it was feasible to implement a mindfulness intervention in a controlled hospital environment. The children's hospital provided an appropriate context for investigating the effects of attention interventions on children experiencing stress and emotional challenges related to hospitalization.

Sample

A convenience sample of 60 school-aged paediatric patients was recruited from the Maternity and Children Hospital paediatric ward in the northern region of the Kingdom of Saudi Arabia. Participants were systematically allocated to one of two groups: an intervention group ($n=30$), which received a 2-week mindfulness program in addition to standard care, and a control group ($n=30$), which received only standard care without the mindfulness intervention. The allocation process was based on the hospital's admission order, with every other eligible patient assigned to the intervention group. This systematic allocation method was chosen to ensure a balanced distribution between groups while accommodating the logistical constraints of the clinical setting.

Figure 1 visually represents the study's flow and group assignments.

Patients aged 6–12 years with an expected hospital stay of at least two weeks were enrolled to ensure completion of the mindfulness program. In addition to the children, parents/guardians of the child participants and nurses from the pediatric ward were invited to provide supplementary feedback. A total of 30 parents completed surveys assessing their child's stress, mood, and coping abilities before and after the intervention. Similarly, 20 nurses participated in surveys assessing their observations of the children's stress levels and behavior. A smaller subset of 5 nurses also participated in a focus group to provide in-depth feedback on the feasibility of integrating the mindfulness program into routine nursing care.

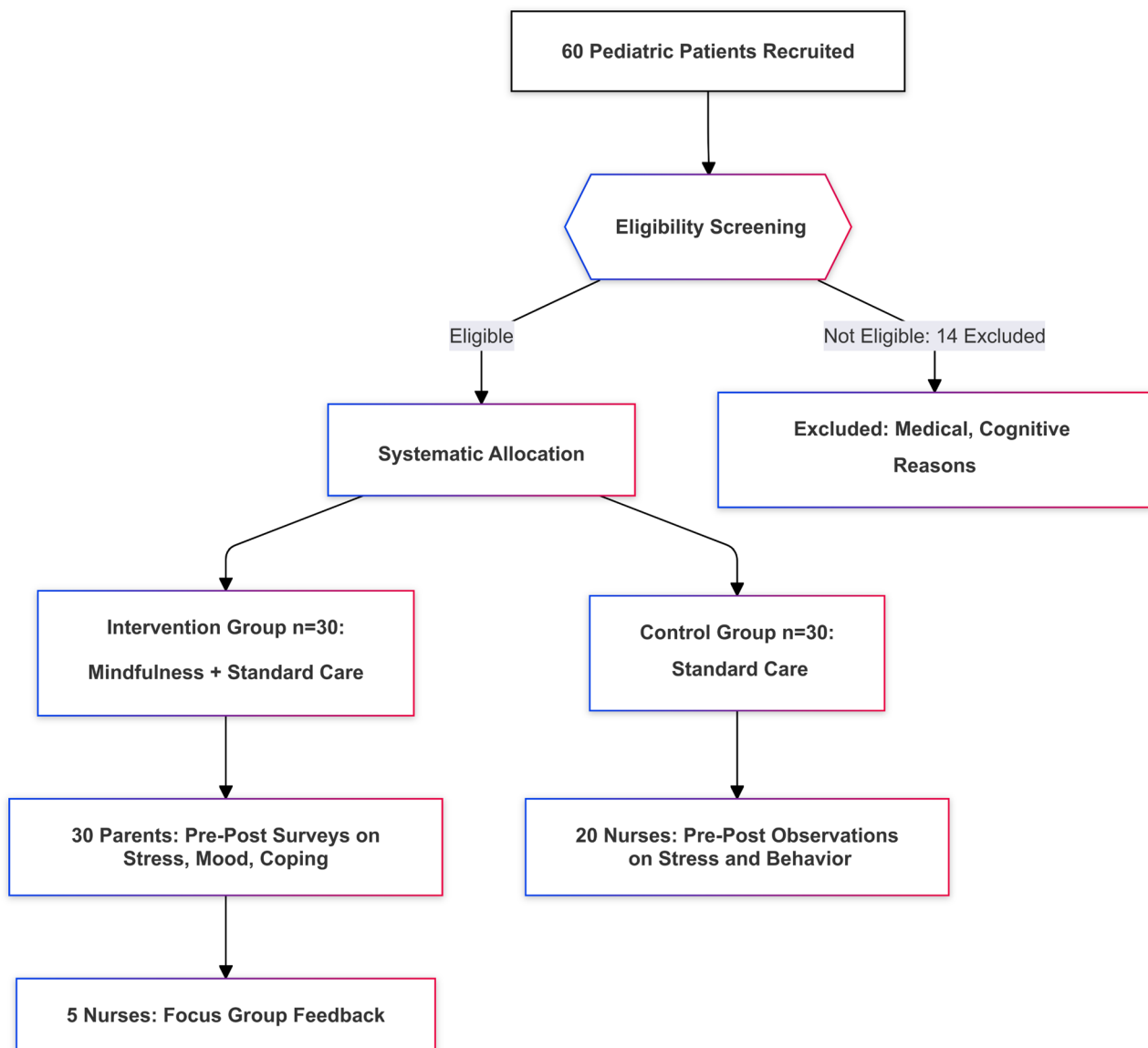


Fig. 1 Flowchart of Sample Recruitment, Group Allocation, and Feedback Collection Process

The sample size for the pediatric patients was determined using G*Power software, accounting for an 80% power, an alpha of 0.05, and a medium effect size of 0.5 for the primary outcome of perceived stress. This analysis indicated a target sample size of 64 pediatric patients, with an initial recruitment goal of 74 to account for a 15% attrition rate. Due to logistical constraints within the hospital, the final sample consisted of 60 patients: 30 in the intervention group and 30 in the control group.

To assess the impact of this reduction on statistical power, we conducted a post-hoc power analysis using G*Power software. With the achieved sample size of 60, an alpha of 0.05, and the observed effect sizes for our primary outcomes (Cohen's d ranging from 0.72 to 1.05 as reported in Table 1), the study maintained a power of 0.85 to 0.99 for detecting significant effects. This indicates that despite the slight reduction in sample size, the study retained sufficient statistical power to detect meaningful differences between groups. However, this may have marginally increased the risk of Type II errors for outcomes with smaller effect sizes.

The parent and nurse sample sizes were based on availability and willingness to participate during the study period. Although the primary focus of the study was on the pediatric participants' emotional well-being, feedback from parents and nurses provided valuable supplementary insights into the program's impact and feasibility.

Participants

Children aged 6–12 years who were hospitalized in the pediatric ward were eligible if they had an expected hospital stay of at least two weeks, could communicate in the language of instruction, and provided assent along with parental consent. Children were excluded if they had severe cognitive or developmental impairments, were medically unstable, were participating in other psychosocial interventions, required isolation, or refused to participate.

Table 1 Effect sizes for key psychological outcomes

Outcome	Cohen's d	95% CI	Statistical Significance (p-value)
PSS-C	0.89	[0.53, 1.25]	< 0.001
SCARED	0.72	[0.37, 1.07]	0.002
SMFQ	0.85	[0.49, 1.21]	< 0.001
PROMIS Fatigue	0.78	[0.42, 1.14]	< 0.001

Cohen's d interpretation: Small (0.2), Medium (0.5), Large (0.8)
Confidence intervals show the range within which the true effect size likely falls
Effect sizes above 0.8 are considered large and indicate strong effects
Statistical significance (p-value) confirms that these effects are unlikely due to chance

Data collection tools

Quantitative data collection tools

1. Perceived Stress Scale for Children (PSS-C)
The Perceived Stress Scale for Children (PSS-C) is a modified 10-item self-report questionnaire designed to measure perceived stress levels in children [64–66]. In this study, a validated Arabic version of the PSS-C was utilized [67, 68]. Responses were rated on a 5-point Likert scale, with total scores ranging from 0 to 40; higher scores indicate greater perceived stress [64]. The PSS-C is adapted for pediatric populations using age-appropriate language and examples to ensure comprehension [66, 69]. In our sample, the PSS-C demonstrated good internal consistency (Cronbach's $\alpha = 0.80$), supporting its reliability in assessing perceived stress in children aged 6–12 years.
2. Pediatric PROMIS fatigue scale
The 8-item PROMIS Fatigue Scale assesses fatigue in children [70–72]. A validated Arabic version was used, showing excellent internal consistency (Cronbach's $\alpha = 0.92$) and test-retest reliability (ICC = 0.78) [73–75]. Scores were converted to standardized T-scores (mean = 50, SD = 10) [76].
3. Mood and feelings questionnaire (MFQ)
The SMFQ is a 13-item self-report tool for depressive symptoms in youth, with scores ranging from 0 to 26 [77]. The Arabic version demonstrated strong internal consistency ($\alpha = 0.82$) and good test-retest reliability ($r = 0.65$) [78]. A cut-off score of 11 indicates clinically significant depressive symptoms [79, 80].
4. Screen for child anxiety related emotional disorders (SCARED)
The SCARED is a 41-item tool assessing anxiety across five dimensions [81, 82]. The Arabic version showed high internal consistency (Cronbach's $\alpha = 0.91$) and good test-retest reliability ($r = 0.80$) [83, 84]. A cut-off score of 25 suggests an anxiety disorder [85]. While the SCARED and SMFQ are typically validated for children aged eight and above, we included children as young as 6 years by implementing several strategies: (1) conducting cognitive interviews to ensure comprehension; (2) slightly modifying item wording for younger children; (3) providing assisted administration by trained research assistants; (4) collecting parallel parent reports for cross-validation; (5) performing subgroup analysis to identify differences in response patterns. These adaptations allowed us to include younger participants while maintaining data integrity. However, we acknowledge this as a study

limitation, and results for the youngest participants should be interpreted cautiously.

For tools typically validated for children aged eight and above, we included younger children (6–8 years) by modifying item wording, conducting cognitive interviews, using assisted administration, and performing subgroup analysis. This ensured comprehension and data integrity while acknowledging this as a study limitation.

Qualitative data collection tools

1. Semi-structured Post-Intervention Interviews with Child Participants

Individual semi-structured interviews were conducted with intervention group participants ($n = 30$) to evaluate program acceptability and effectiveness. The interview protocol addressed four domains: program experience, skill application, group dynamics, and hospital integration. Interviews lasting 15–30 min were audio-recorded, professionally transcribed verbatim, and translated when necessary. Two independent researchers conducted inductive thematic analysis following Braun and Clarke's methodology [86]. Inter-rater reliability was established (Cohen's $\kappa = 0.85$), with discrepancies resolved through consensus meetings. Analysis followed systematic coding procedures: initial coding, theme development, and hierarchical organization of themes, with member checking to ensure interpretive validity [87].

2. Parent survey and interviews

Parental perspectives were assessed through mixed methods. A validated 15-item Likert scale survey ($\alpha = 0.86$) evaluated intervention impact across four domains: stress reduction, mood improvement, coping skills, and ward interactions ($n = 30$). Subsequently, purposively sampled parents ($n = 10$) participated in semi-structured telephone interviews (30 min) exploring intervention benefits and implementation. Interview transcripts underwent independent thematic analysis by two researchers with consensus meetings to ensure analytical rigor (Cohen's $\kappa = 0.82$) [88]. Data triangulation between survey and interview findings enhanced the validity of parental perspectives.

3. Post-Intervention survey and focus group with nursing staff

Healthcare provider perspectives were evaluated through dual methods. Nurses ($n = 20$) completed a validated 10-item Likert scale survey ($\alpha = 0.81$) assessing intervention impact on patient outcomes and care delivery. A subsequent focus group ($n = 5$,

60 min) explored implementation feasibility, clinical integration, and sustainability. Focus group data underwent thematic analysis by two independent researchers following established guidelines, with member checking to ensure interpretive accuracy (Cohen's $\kappa = 0.84$) [89, 90].

Ethical considerations

The Institutional Bioethics Review Board of Jouf University granted ethical permission for this study in compliance with the Declaration of Helsinki's criteria (approval number 4–06-45). This ensured the ethical conduct of the study by upholding the principles of respect for persons, beneficence, and justice. Approval stipulated that informed consent had to be obtained from the legal guardians of all child participants. In addition to parental consent, we obtained assent from all child participants using an age-appropriate process. For children aged 6–9, we used a simplified assent form with pictorial aids and simple language, which was read aloud to them. Children aged 10–12 were provided with a more detailed but still age-appropriate written assent form. In both cases, trained research assistants explained the study's purpose, procedures, and the child's right to withdraw at any time using child-friendly language. Children were encouraged to ask questions, and their understanding was verified through a teach-back method where they explained key points in their own words. Assent was documented through the child's signature or a thumbprint for younger children. We emphasized that declining participation would not affect their medical care, and continuous assent was sought throughout the study.

Each child participant received a unique code number, and all information was reported in an aggregated form to protect confidentiality. A password-protected computerized system safely handled the data. In addition, participation was entirely voluntary, with the freedom to withdraw at any time without penalty. The well-being and dignity of participants were prioritized, with their health status continually monitored. Any adverse events or protocol changes were reported to the ethics committee. This ethical oversight protected the rights and welfare of the vulnerable paediatric population involved in the research.

Procedure

This mixed-methods quasi-experimental study was conducted following approval from the Institutional Bioethics Review Board of Jouf University (approval number 4–06-45). A sample of 60 hospitalized children aged 6–12 years was recruited from the paediatric ward of Maternity and Children Hospital in northern Saudi Arabia. After obtaining informed consent from parents and

assent from children. Participants were systematically allocated to either the intervention ($n=30$) or control ($n=30$) group using a predetermined sequence based on admission order. This allocation method ensured a balanced distribution between groups while accommodating the logistical constraints of the hospital setting. The intervention group participated in a 2-week nurse-led mindfulness program, while the control group received standard care. Baseline assessments were conducted using validated Arabic versions of the Perceived Stress Scale for Children (PSS-C), Paediatric PROMIS Fatigue Scale, Short Mood and Feelings Questionnaire (SMFQ), and Screen for Child Anxiety Related Emotional Disorders (SCARED). Demographic and medical information was collected from hospital records and parent interviews.

The administration of self-report scales, especially to younger children or those with limited reading skills, followed a structured protocol. Trained research assistants conducted one-on-one sessions in a quiet area of the paediatric ward. For children aged 6–8 or those with reading difficulties, items were read aloud. Visual aids (e.g., smiley face scales) were used to assist in responses. Comprehension was checked by asking children to rephrase questions. Ample time and breaks were provided as needed. Standardized, non-leading prompts were used for clarification. Parents could be present for reassurance but were instructed not to influence responses. This approach balanced standardized administration with necessary adaptations for young children.

The intervention group participated in a 2-week nurse-led mindfulness program, while the control group received standard care. The mindfulness program consisted of daily 30-minute sessions incorporating age-appropriate techniques:

1. Mindful Breathing Exercises (4 sessions): Included belly breathing, counting breaths, bubble breathing visualization, and 'smell the flower, blow the candle' exercise.
2. Body Scan and Progressive Muscle Relaxation (3 sessions): Featured simplified body scan, 'spaghetti body' relaxation, and 'squeezing lemons' hand relaxation.
3. Mindful Movement and Yoga (3 sessions): Incorporated child-friendly yoga poses, mindful walking (adapted for bed-bound children), and 'shake and freeze' movement game.
4. Guided Imagery and Visualization (2 sessions): Utilized 'safe place' visualization and 'floating on a cloud' relaxation story.
5. Mindful Art Activities (2 sessions): Included mindful colouring and creating a 'feelings mandala'.

The mindfulness techniques incorporated into the intervention were selected based on their alignment with the psychological and cognitive development of school-aged children. At this developmental stage, children are rapidly improving their ability to understand and regulate emotions, making them particularly receptive to mindfulness practices that promote self-awareness and emotional control. Techniques such as mindful breathing, body scan, and guided imagery were chosen for their ability to engage children's imagination while simultaneously fostering relaxation and coping skills. Furthermore, activities like mindful movement and art therapy tap into children's natural inclination towards physical activity and creativity, making the intervention both developmentally appropriate and engaging. Sessions were conducted at the bedside when necessary and adapted to accommodate medical conditions. Supplementary materials, including mindfulness activity books and guided meditation recordings, were provided to children. Parents were encouraged to observe sessions and practice techniques with their children.

To ensure fidelity to the intervention protocol, several measures were implemented. All nurses delivering the intervention underwent a comprehensive 16-hour training program on paediatric mindfulness techniques. A detailed manual outlining each session's content, activities, and delivery methods was provided to all facilitators. Senior researchers observed 20% of the sessions randomly and provided immediate feedback to facilitators. Facilitators completed a fidelity checklist after each session, documenting adherence to key intervention components. Group supervision meetings were held weekly to discuss challenges and maintain consistency in delivery. With parental consent, 10% of sessions were audio-recorded and reviewed by an independent rater for adherence to the protocol. Additionally, brief post-session surveys were administered to children and parents to assess their perception of the intervention's delivery. These measures collectively ensured consistent implementation of the mindfulness intervention across all participants and facilitators.

Intervention fidelity was monitored through regular observations and weekly meetings with implementing nurses, who received 16 h of training in paediatric mindfulness techniques. Cultural adaptations were made to ensure appropriateness for the Saudi Arabian context. Post-intervention, all quantitative measures were re-administered to both groups. Qualitative data were collected through semi-structured interviews with a subset of children from the intervention group, surveys and interviews with parents ($n=30$), and surveys and a focus group with nursing staff ($n=20$). All interviews and focus groups were audio-recorded, transcribed verbatim, and translated when necessary.

Quantitative data were analyzed using SPSS (version 28), employing descriptive statistics, paired t-tests for within-group comparisons, and independent t-tests for between-group comparisons. Qualitative data underwent thematic analysis using a coding framework developed by two independent researchers. The convergent parallel mixed-methods design facilitated the integration of quantitative and qualitative findings.

Statistical analysis

Data analysis was conducted using SPSS (version 28), with significance set at $p < 0.05$ for all statistical tests. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were calculated for all demographic and clinical variables. Independent t-tests and Chi-square tests were employed to compare baseline characteristics between the intervention and control groups. For the primary outcomes, paired t-tests were used to evaluate within-group differences pre- and post-intervention, while independent t-tests assessed between-group differences. Effect sizes were calculated

Table 2 Demographic and clinical characteristics of the study sample ($N = 60$)

Characteristic	Intervention Group ($n = 30$) N (%)	Control Group ($n = 30$) N (%)	Total Sample ($N = 60$)	P-value
Age (years):				0.86
6–8	15 (50%)	18 (60%)	33 (55%)	
9–12	15 (50%)	12 (40%)	27 (45%)	
Mean $\pm$ SD	9 $\pm$ 2	10 $\pm$ 2		
Gender:				0.77
Male	16 (53%)	14 (47%)	30 (50%)	
Female	14 (47%)	16 (53%)	30 (50%)	
Nationality:				0.68
Saudi	25 (83%)	26 (87%)	51 (85%)	
Non-Saudi	5 (17%)	4 (13%)	9 (15%)	
Length of Hospital Stay (days):				0.46
5–7	12 (40%)	10 (33%)	22 (37%)	
8–10	9 (30%)	11 (37%)	20 (33%)	
> 10	9 (30%)	9 (30%)	18 (30%)	
Mean $\pm$ SD	7 $\pm$ 2	8 $\pm$ 3		
Medical Condition:				0.99
Respiratory	8 (27%)	7 (23%)	15 (25%)	
Gastrointestinal	5 (17%)	6 (20%)	11 (18%)	
Cardiac	4 (13%)	3 (10%)	7 (12%)	
Neurological	3 (10%)	4 (13%)	7 (12%)	
Other (Dermatological, Endocrine, etc.)	10 (33%)	10 (33%)	20 (33%)	

P-values reflect the results of independent t-tests or Chi-square tests comparing the intervention and control groups for continuous and categorical variables, respectively

-The length of stay data reflects the actual duration of hospitalization. All participants were enrolled with an expected two-week stay at the time of recruitment, as determined by their treating physicians

using Cohen's d , with 0.2, 0.5, and 0.8 interpreted as small, medium, and large effects, respectively. Multiple linear regression analysis was employed to identify predictors of psychological outcomes, controlling for potential confounders such as age, gender, length of hospital stay, and severity of the medical condition. The qualitative data from interviews and surveys were analyzed using thematic analysis to identify recurring themes, and triangulation was applied to integrate the quantitative and qualitative findings for a comprehensive understanding of the intervention's impact.

Given the relatively small sample size ($n = 60$) and the potential for non-normal data distributions, we took several steps to ensure the appropriateness of our statistical analyses. First, we assessed the normality of data distributions using Shapiro-Wilk tests and Q-Q plots for each outcome measure. For variables that violated normality assumptions, we applied appropriate transformations (e.g., log transformation) to improve distribution normality. In cases where transformations did not sufficiently normalize the data, we employed non-parametric alternatives: Mann-Whitney U tests instead of independent t-tests, Wilcoxon signed-rank tests instead of paired t-tests, and Spearman's rank correlations instead of Pearson's correlations. For regression analyses, we checked for multicollinearity, homoscedasticity, and influential outliers using variance inflation factors, residual plots, and Cook's distance, respectively. When regression assumptions were violated, we used robust regression techniques or generalized linear models as appropriate. Additionally, we conducted sensitivity analyses comparing the results of parametric and non-parametric tests to ensure the robustness of our findings. These steps were taken to ensure the validity of our statistical inferences given the constraints of our sample size and data characteristics.

Results

The following section presents the study's results, which aimed to evaluate the psychological effects of a nurse-led mindfulness-based intervention on hospitalized school-aged children. The analysis focuses on a range of psychological outcomes, including stress, anxiety, mood, and fatigue. Subsequently, the study assessed changes in psychological measures from pre- to post-intervention, highlighting significant within- and between-group differences. Additionally, multiple regression analyses were conducted to identify key predictors of psychological outcomes, followed by a qualitative analysis that explored participants' experiences and perceptions of the intervention. Finally, subgroup analyses were performed to examine potential variations in intervention effects based on age and length of hospital stay.

The demographic and clinical characteristics presented in Table 2 reveal that there were no statistically

Table 3 Pre- and Post-Intervention psychological measures

Measure	Group	Pre (T0)	Post (T1)	Within-group <i>p</i> -value	Between-group <i>p</i> -value	Effect Size (Cohen's <i>d</i>)
PSS-C	Intervention	22.4 ± 5.2	17.1 ± 4.8	< 0.001	< 0.001	1.05
	Control	21.9 ± 5.0	21.5 ± 5.1	0.39	-	0.08
SCARED	Intervention	33.2 ± 8.7	28.4 ± 7.9	< 0.001	0.002	0.67
	Control	32.8 ± 8.5	32.1 ± 8.3	0.21	-	0.11
SMFQ	Intervention	9.8 ± 3.6	6.3 ± 3.1	< 0.001	< 0.001	0.88
	Control	9.5 ± 3.4	9.2 ± 3.5	0.35	-	0.1
PROMIS Fatigue	Intervention	58.6 ± 7.2	52.1 ± 6.8	< 0.001	< 0.001	0.94
	Control	57.9 ± 7.0	57.3 ± 7.1	0.28	-	0.09

Within-group *p*-values: Statistically significant if *p* < 0.05

Between-group *p*-values: Statistically significant if *p* < 0.05

Effect Size (Cohen's *d*): Interpreted as small (~0.2), medium (~0.5), large (~0.8)

Table 4 Multiple regression analysis for predictors of psychological outcomes

Outcome	Predictor	Standardized β	<i>p</i> -value	95% CI (β)	<i>R</i> ²
Δ PSS-C	Intervention	-0.52	< 0.001	(-0.70, -0.34)	0.58
	Age	-0.18	0.04	(-0.32, -0.04)	
	Gender (female)	0.09	0.28	(-0.07, 0.25)	
	Length of stay	-0.15	0.07	(-0.31, 0.01)	
	Severity of condition	0.21	0.02	(0.04, 0.38)	
Δ SCARED	Intervention	-0.48	< 0.001	(-0.65, -0.31)	0.51
	Age	-0.22	0.01	(-0.39, -0.05)	
	Gender (female)	0.11	0.19	(-0.05, 0.27)	
	Length of stay	-0.13	0.12	(-0.29, 0.03)	
	Severity of condition	0.18	0.03	(0.02, 0.34)	

*R*² values represent the overall model fit for each outcome (PSS-C and SCARED)

Standardized β coefficients indicate the strength and direction of each predictor's relationship with the outcome

P-values < 0.05 are considered statistically significant

Gender is coded as 0 for males and 1 for females

The severity of the condition is measured on a standardized scale

PSS-C Perceived Stress Scale, SCARED Screen for Child Anxiety Related Emotional Disorders, Δ change in score from pre- to post-intervention, CI Confidence Interval

significant differences between the intervention and control groups across all measured variables. Age, gender, nationality, length of hospital stays, and medical conditions were comparable between groups, as indicated by *p*-values greater than 0.05. The lack of significant variation (e.g., *p* = 0.86 for age, *p* = 0.77 for gender, and *p* = 0.99 for medical conditions) suggests that the recruitment process effectively ensured demographic balance across

the two groups. Consequently, the observed effects of the intervention can be more confidently attributed to the intervention itself rather than baseline differences.

Table 3 presents the pre-and post-intervention psychological measures, highlighting significant differences both within and between groups for the intervention across all measures. In the intervention group, there were statistically significant improvements from pre- to post-intervention in Perceived Stress Scale for Children (PSS-C), Screen for Child Anxiety Related Emotional Disorders (SCARED), Short Mood and Feelings Questionnaire (SMFQ), and PROMIS Fatigue scores, with *p*-values all less than 0.001, indicating strong intervention effects. Additionally, large effect sizes were observed for these measures (e.g., Cohen's *d* = 1.05 for PSS, 0.67 for SCARED, 0.88 for SMFQ, and 0.94 for PROMIS Fatigue), suggesting a substantial clinical impact of the intervention. In contrast, the control group showed no significant changes over time, with within-group *p*-values consistently greater than 0.05 and small effect sizes (e.g., Cohen's *d* = 0.08 for PSS). The between-group comparisons further reinforce the effectiveness of the intervention, with significant *p*-values (< 0.001 for most measures), underscoring the intervention's superiority over control.

Table 4 presents the results of multiple regression analyses for predictors of psychological outcomes, specifically changes in (Δ PSS-C) and Screen for Child Anxiety Related Emotional Disorders (Δ SCARED). The models for both outcomes demonstrate a strong overall fit, with *R*² values of 0.58 and 0.51, respectively, indicating that the predictors collectively explain a substantial proportion of the variance in psychological outcomes.

The intervention was the strongest predictor of improvement in both Δ PSS (β = -0.52, *p* < 0.001) and Δ SCARED (β = -0.48, *p* < 0.001), with negative standardized beta coefficients reflecting significant reductions in stress and anxiety following the intervention. Age was also a significant predictor for both outcomes, though its effect was more modest (β = -0.18, *p* = 0.04 for Δ PSS; β

Table 5 Qualitative themes from interviews

Theme	Representative Quote	Context/Source	Prevalence
Relaxation and coping	"The breathing exercises really helped me feel calmer before procedures. I was scared, but after we practiced it a few times, it was easier to handle the stress."	Child participant (after 1 week of intervention)	Mentioned by 70% of children and parents
Emotional control	"I noticed my child was better able to express their feelings after the mindfulness sessions. It was like he learned to slow down and think before reacting."	Parent (post-intervention follow-up)	Observed by 60% of parents
Positive hospital experience	"The mindfulness activities made the hospital stay feel less stressful. I even liked doing the yoga exercises when I felt bored or sad."	Child participant (post-intervention)	65% of participants (children and parents)
Feasibility of integration	"Once we got into a routine, it was manageable to incorporate mindfulness exercises into care. Initially, it took time, but once familiar, it became part of daily care."	Nurse (focus group, after two weeks)	Discussed by 80% of nurses
Challenges	"Some of the kids didn't seem interested in the mindfulness exercises, especially when they were in pain. It was hard to keep them engaged during certain activities."	Nurse (focus group)	Brought up by 30% of nurses
Barriers to participation	"I found it difficult to keep practicing mindfulness at home after the hospital stay ended since we didn't have the same routine and environment."	Parent (post-discharge follow-up)	40% of parents

= -0.22, $p = 0.01$ for Δ SCARED), suggesting that younger participants experienced greater improvements.

The severity of the condition emerged as a significant positive predictor, indicating that participants with more severe conditions showed less reduction in stress and anxiety ($\beta = 0.21$, $p = 0.02$ for Δ PSS; $\beta = 0.18$, $p = 0.03$ for Δ SCARED). Neither gender nor length of hospital stay had statistically significant effects on the psychological outcomes, with p-values exceeding 0.05 for both predictors across both models.

In summary, the intervention and participant age were the most influential factors in reducing psychological distress, while higher severity of medical conditions predicted less favorable psychological outcomes. These findings underscore the efficacy of the intervention in mitigating stress and anxiety, particularly in younger children, and highlight the moderating effect of clinical severity on psychological recovery.

Table 5 summarizes the qualitative themes identified from interviews with children, parents, and nurses, capturing key insights into the intervention's impact. The data reflect diverse participant experiences, with relaxation and coping, emotional control, and a positive hospital experience emerging as prevalent themes, particularly noted by children and parents. Relaxation techniques, such as breathing exercises, were widely appreciated, with 70% of participants indicating they helped manage stress. Emotional control, reported by 60% of parents, highlights the intervention's success in teaching children to process and regulate their emotions more effectively.

Nurses who discussed the feasibility of integrating mindfulness into routine care emphasized that once familiar with the exercises, 80% found it feasible to incorporate into daily practice. However, challenges to sustained engagement, particularly when children were in pain, were highlighted by 30% of nurses. Barriers to continued mindfulness practice post-discharge were also noted, with 40% of parents struggling to maintain the routine without the structured hospital environment. These findings illustrate both the strengths and the limitations of the intervention, offering valuable perspectives on its practical implementation and areas for potential improvement.

Barriers to feasibility and implementation

While the qualitative data highlighted the benefits of the intervention, several participants, particularly nurses and parents, identified challenges related to its feasibility and implementation within the hospital setting. Nurses reported difficulties in integrating mindfulness activities into the daily workflow, particularly during busy shifts or when patients were in acute distress. For example, one nurse remarked, "We struggled to fit the sessions into the daily care schedule, especially during peak times. The kids'

Table 6 Parent and nurse satisfaction with the intervention

Aspect	Parents (n = 30)	Nurses (n = 20)
Stress reduction	4.2 ± 0.8	4.0 ± 0.7
Mood improvement	4.3 ± 0.7	4.1 ± 0.8
Feasibility	3.9 ± 0.9	3.7 ± 1.0
Overall satisfaction	4.4 ± 0.6	4.2 ± 0.7

*Scores are based on a 5-point Likert scale (1=Very Dissatisfied, 5=Very Satisfied). No significant differences between parent and nurse satisfaction scores ($p > 0.05$) were found using independent t-tests

attention was difficult to hold after long treatments, so mindfulness wasn't always practical in every situation."

Parents echoed these concerns, with some noting that their child's mood or pain levels affected their ability to participate consistently. One parent mentioned, *"It was hard to keep up with the mindfulness exercises when my child was in pain or after long procedures. We skipped some sessions, and it felt like the routine was disrupted."*

These findings suggest that, while the intervention was generally well-received, its implementation may need to be more flexible to accommodate the realities of hospital care, patient conditions, and staff workload.

Outliers and neutral feedback

In addition to the primarily positive feedback, some participants reported neutral or less favorable experiences with the mindfulness intervention. A few parents and nurses noted that the intervention did not significantly impact all children. One nurse reflected,

"Some children, particularly the younger ones, didn't seem to engage with the mindfulness exercises at all. They were either distracted or uninterested, and it felt like the intervention wasn't working for them."

Similarly, a parent commented, *"I didn't see much change in my child's stress levels, especially on days when we didn't manage to do the exercises. It was helpful sometimes, but not a huge difference overall."*

These outlier responses indicate that the intervention may not be universally effective for all patients. Variability in engagement and outcomes suggests that factors such as age, patient mood, and overall condition may influence the intervention's success.

Table 6 presents the satisfaction ratings from parents and nurses regarding the intervention, with scores measured on a 5-point Likert scale. Both groups reported generally high satisfaction across all aspects, with no statistically significant differences between parent and nurse responses ($p > 0.05$). Parents rated overall satisfaction the highest, with a mean score of 4.4 ± 0.6 , indicating strong approval of the intervention. Nurses similarly reported high satisfaction, particularly with mood improvement (4.1 ± 0.8) and stress reduction (4.0 ± 0.7), although they noted slightly lower feasibility (3.7 ± 1.0), suggesting some minor challenges in implementation. The consistently positive ratings across both groups reinforce the

Table 7 Subgroup analysis of intervention effects by age

Outcome	6–9 years (n = 16)	10–12 years (n = 14)	p-value	Cohen's d [95% CI]
Δ PSS-C	−6.2 ± 2.1	−4.5 ± 1.9	0.03*	0.84 [0.12, 1.56]
Δ SCARED	−5.8 ± 2.4	−4.0 ± 2.2	0.04*	0.77 [0.05, 1.49]
Δ SMFQ	−4.1 ± 1.8	−3.0 ± 1.6	0.08	0.64 [−0.07, 1.35]
Δ PROMIS Fatigue	−7.4 ± 2.9	−5.6 ± 2.7	0.07	0.63 [−0.08, 1.34]

Δ represents a change in score from pre- to post-intervention

Values are presented as mean ± standard deviation

p-values are from independent t-tests comparing subgroups

Cohen's d effect sizes: small (0.2), medium (0.5), large (0.8)

CI Confidence Interval

*Indicates statistical significance at $p < 0.05$

intervention's perceived effectiveness and acceptability in reducing stress and improving mood while highlighting that the practical aspects of integrating the intervention into routine care may require further refinement. These findings suggest that with minor adjustments, the intervention could be more seamlessly incorporated into clinical practice, further enhancing patient and provider satisfaction.

Table 7 outlines the subgroup analysis of the intervention effects by age, showing statistically significant differences between the two age groups (6–9 years and 10–12 years) in terms of improvements in psychological outcomes. The younger group (6–9 years) exhibited more pronounced reductions in both PSS-C (Perceived Stress Scale for Children) and SCARED (Screen for Child Anxiety Related Emotional Disorders), with p-values of 0.03 and 0.04, respectively, indicating significant intervention effects. The corresponding effect sizes (Cohen's $d = 0.84$ and 0.77) suggest large and moderate impacts of the intervention in these areas.

While there were noticeable improvements in SMFQ (Short Mood and Feelings Questionnaire) and PROMIS Fatigue scores for both age groups, these changes did not reach statistical significance ($p = 0.08$ and $p = 0.07$). However, the effect sizes indicate moderate practical relevance (Cohen's $d = 0.64$ and 0.63). These findings highlight that younger children (6–9 years) benefited more from the intervention regarding stress and anxiety reduction, while older children (10–12 years) showed slightly less improvement across outcomes. This age-based differentiation suggests tailoring interventions to developmental stages may enhance their effectiveness.

Table 8 provides a subgroup analysis of the intervention's effects based on the length of hospital stay (<14 days vs. ≥14 days). While there are no statistically

Table 8 Subgroup analysis of intervention effects by length of stay

Outcome	< 14 days (n = 13)	≥ 14 days (n = 17)	p-value	Cohen's d [95% CI]
Δ PSS-C	-4.8 ± 2.0	-5.9 ± 2.2	0.16	0.52 [-0.21, 1.25]
Δ SCARED	-4.3 ± 2.3	-5.5 ± 2.5	0.18	0.49 [-0.24, 1.22]
Δ SMFQ	-3.2 ± 1.7	-3.9 ± 1.9	0.28	0.38 [-0.34, 1.10]
Δ PROMIS Fatigue	-5.9 ± 2.8	-7.1 ± 3.0	0.25	0.41 [-0.31, 1.13]

Δ represents a change in score from pre- to post-intervention

Values are presented as mean ± standard deviation

p-values are from independent t-tests comparing subgroups

Cohen's d effect sizes: small (0.2), medium (0.5), large (0.8)

CI/Confidence Interval

*Indicates statistical significance at $p < 0.05$

significant differences between the two groups across all outcomes ($p > 0.05$), the group with a longer hospital stay (≥ 14 days) demonstrated slightly larger improvements in stress (Δ PSS-C: -5.9 ± 2.2), anxiety (Δ SCARED: -5.5 ± 2.5), mood (Δ SMFQ: -3.9 ± 1.9), and fatigue (Δ PROMIS Fatigue: -7.1 ± 3.0) compared to those with shorter stays.

Effect sizes (Cohen's d) ranged from 0.38 to 0.52, indicating moderate practical relevance. The largest effect was observed in PSS ($d = 0.52$), suggesting that the intervention may have a stronger impact on reducing perceived stress in patients with prolonged hospitalizations. However, the wide confidence intervals and p-values suggest these differences may be clinically relevant but not statistically robust. Overall, the data imply that while longer hospital stays may offer more opportunities for psychological improvement through the intervention, the duration of the stay does not significantly alter the intervention's overall effectiveness.

Table 1 presents the effect sizes for key psychological outcomes, demonstrating that the intervention had a significant and strong impact across all measures. The effect sizes for the Perceived Stress Scale (PSS-C: Cohen's $d = 0.89$), Screen for Child Anxiety Related Emotional Disorders (SCARED: $d = 0.72$), Short Mood and Feelings Questionnaire (SMFQ: $d = 0.85$), and PROMIS Fatigue ($d = 0.78$) all fall within the medium to large range, with the largest effects observed for PSS and SMFQ, indicating substantial reductions in stress and mood symptoms post-intervention. The statistical significance for all outcomes ($p < 0.001$ for PSS, SMFQ, and PROMIS Fatigue; $p = 0.002$ for SCARED) confirms that these effects are unlikely to be due to chance. Confidence intervals for Cohen's d reflect the precision of these estimates, all of which support the robustness of the observed intervention effects. These findings underscore the intervention's

effectiveness in reducing stress, anxiety, depressive symptoms, and fatigue, with large practical significance across multiple psychological domains.

Discussion

This study aimed to evaluate the efficacy of a nurse-led mindfulness-based intervention on the psychological well-being of hospitalized school-aged children. The findings demonstrate significant improvements in stress reduction, anxiety management, mood enhancement, and fatigue levels among children receiving the intervention compared to those receiving standard care. These results contribute to the growing body of evidence supporting the use of mindfulness practices in paediatric healthcare settings.

Effectiveness of the mindfulness intervention

The substantial reductions in Perceived Stress Scale for Children (PSS-C) scores (Cohen's $d = 1.05$) observed in the intervention group align with previous research highlighting mindfulness as an effective tool for managing stress in pediatric populations [91–95]. This large effect size suggests that the intervention significantly impacted children's stress levels during hospitalization. However, it is important to note that some studies have reported inconsistent results, particularly when interventions are not tailored to children's developmental stages [51]. This underscores the importance of age-appropriate adaptations in mindfulness practices for pediatric populations.

The significant improvements in anxiety, as measured by SCARED scores (Cohen's $d = 0.67$), corroborate findings from meta-analyses such as Borquist-Conlon et al. (2019), which found that mindfulness interventions can effectively reduce anxiety in youth [50]. However, conflicting evidence suggests that the effectiveness of mindfulness on anxiety reduction may be moderated by the severity of medical conditions [96]. This highlights the need for future research to investigate how mindfulness interventions' efficacy may vary across paediatric patient populations and medical conditions.

Positive changes in mood, reflected by improvements in Short Mood and Feelings Questionnaire (SMFQ) scores (Cohen's $d = 0.88$), further support the growing body of evidence on the efficacy of mindfulness interventions in improving emotional well-being among children [10]. The large effect size observed in this study suggests that the mindfulness intervention substantially impacted children's mood during hospitalization. However, some research indicates that the effects on mood may be limited without supplementary psychosocial support [16, 97]. This suggests that while mindfulness can be a powerful tool for improving mood, it may be most effective when integrated into a comprehensive approach to

pediatric care that addresses multiple aspects of children's psychological well-being.

The intervention's ability to reduce fatigue, as demonstrated by the significant change in PROMIS Fatigue scores (Cohen's $d = 0.94$), is particularly noteworthy given the physical and emotional demands of hospitalization on children. This finding aligns with previous research suggesting that mindfulness can alleviate physical symptoms such as fatigue in both adults and children [98]. However, the relationship between mindfulness and fatigue reduction may be more complex in children with chronic illnesses, where fatigue is often multifactorial and may require multi-disciplinary approaches [99].

Age-related differences and developmental considerations

The subgroup analysis reveals that younger children (6–9 years) benefited more from the intervention, particularly in stress reduction and anxiety management. This raises important questions about the developmental aspects of mindfulness practice. This finding aligns with research by Campbell et al. (2019), who noted greater improvements in emotional regulation among younger children exposed to mindfulness interventions [100]. The enhanced efficacy in younger children may be attributed to their greater cognitive plasticity and openness to new experiences at this developmental stage.

However, these results contrast with some studies [101–103], which suggests that older children may show stronger engagement with mindfulness due to their more developed cognitive capacities. This discrepancy highlights the critical need for age-specific adaptations in mindfulness practices to maximize effectiveness across different developmental stages. Future research should explore how mindfulness interventions can be tailored to meet children's unique needs and capacities at various ages and developmental levels.

Qualitative insights and integration with quantitative findings

The qualitative component of this study provided valuable insights that complement and enrich the quantitative findings. Thematic analysis of interviews with children, parents, and nurses revealed three primary themes: relaxation, improved coping, and enhanced emotional control.

Themes identified from interviews

Relaxation

Many children reported feeling more relaxed and calmer after participating in mindfulness activities. This aligns with the quantitative reduction in stress and anxiety scores, providing a more nuanced understanding of how children experience these benefits. For example, one child stated, “The breathing exercises really helped me

feel calmer before procedures.” This finding is consistent with research by Veigh et al. (2021) [104], who found that mindfulness techniques can help hospitalized children manage procedure-related anxiety.

Improved coping

Parents and nurses observed that children who participated in the mindfulness intervention demonstrated better coping skills when faced with challenging aspects of hospitalization. This theme supports the quantitative improvements in mood and fatigue scores, suggesting that mindfulness may equip children with practical tools to navigate the hospital experience. This aligns with findings from Othman et al. (2023), who noted improved coping mechanisms in children exposed to mindfulness practices during hospitalization [105].

Enhanced emotional control

Both children and parents reported improvements in emotional regulation. This qualitative finding provides context for the quantitative improvements in mood scores, illustrating how mindfulness practices may help children recognize and manage their emotions more effectively. As one parent noted, “My child seemed better able to express their feelings after the mindfulness sessions.” This observation is consistent with research by Ortiz et al. (2017) on the positive impact of mindfulness on emotional regulation in pediatric patients [106].

The challenges identified in the qualitative feedback, particularly regarding the feasibility of integrating mindfulness into a busy hospital setting, suggest that flexibility in the intervention's application is crucial. Nurses and parents noted that while the intervention was generally beneficial, logistical barriers such as time constraints and patient distress—limited consistent participation. Additionally, outlier feedback from both parents and nurses indicated that some children, especially younger ones, were less engaged with mindfulness exercises. These findings point to the need for further adaptation of the intervention to ensure it is accessible and effective for a broader range of patients, particularly in high-stress, acute care settings.

Integration of quantitative and qualitative findings

Integrating quantitative and qualitative data is crucial in comprehensively understanding the intervention's impact. While the quantitative results demonstrate statistically significant improvements in psychological measures, the qualitative insights offer explanations for these changes and illuminate participants' lived experiences. For instance, the quantitative reduction in anxiety scores is given depth by children's descriptions of feeling calmer during medical procedures, illustrating the practical applications of mindfulness techniques in

the hospital setting. Furthermore, the qualitative data revealed nuances that were not captured by the quantitative measures alone. For example, while the quantitative data showed improvements in mood, the qualitative insights suggested that these improvements were linked to enhanced emotional awareness and expression, providing a richer understanding of the intervention's effects and making us feel more informed and knowledgeable about the subject.

Importance of patient and staff perspectives

Including perspectives from children, parents, and nurses was crucial in evaluating the intervention's effectiveness and feasibility. Patient perspectives provided direct insights into mindfulness practices' acceptability and perceived benefits. At the same time, parent observations offered valuable information about changes in children's behavior and emotional states that might not be captured by self-report measures alone. Nurse perspectives were particularly important in assessing the practical aspects of implementing mindfulness interventions in a busy hospital environment. Their insights highlighted both the potential benefits and the challenges of integrating mindfulness into routine care, providing crucial information for future implementation efforts. As one nurse noted, "Once we got into a routine, it was manageable to incorporate mindfulness exercises into care, but initially, it took time to adjust." This multi-stakeholder approach to evaluation, which aligns with recommendations by Mindet al. (2024) for involving multiple perspectives in pediatric healthcare research, is crucial. It provides a more holistic view of the intervention's impact and makes us feel involved and part of a larger community, working towards a common goal of improving paediatric healthcare through mindfulness interventions [107].

Implementation challenges and clinical implications

While the intervention showed promising results, qualitative data revealed implementation challenges, particularly during periods of acute patient distress. This aligns with studies [16, 97], who noted difficulties in consistently implementing mindfulness interventions in high-stress hospital environments. These challenges underscore the need for flexible and adaptable intervention protocols that can be integrated into the often-unpredictable nature of paediatric hospital care. Parents' difficulty maintaining mindfulness practices post-discharge echoes observations from similar studies [16–108]. This highlights a crucial area for improvement in mindfulness interventions for hospitalized children. Developing strategies to support continued practice after discharge, such as follow-up sessions, take-home materials, or digital mindfulness tools, could help sustain the benefits of the intervention beyond the hospital setting

and potentially lead to long-term improvements in children's psychological well-being.

The high satisfaction rates among parents and nurses regarding the intervention's impact on children's stress reduction and mood improvement are encouraging. This positive feedback suggests that mindfulness interventions can be well-received by both families and healthcare providers, potentially facilitating broader implementation in paediatric healthcare settings. However, the challenges identified by nurses in integrating mindfulness practices into busy hospital routines indicate that successful implementation will require institutional support, adequate training, and potential adjustments to staffing and scheduling to accommodate these practices.

Strengths and limitations of the work

A key strength of this study is its mixed-methods design, which provided comprehensive insights into both the quantitative outcomes and the participants' lived experiences. This approach, advocated by researchers like Puinean et al. (2022), offers a more holistic view of intervention impacts and can help identify factors contributing to the intervention's success or challenges in its implementation [109]. The inclusion of multiple stakeholders' children, parents, and nurses in the qualitative component of the study enhances the credibility of the findings and provides valuable perspectives on the feasibility and acceptability of the intervention in real-world clinical settings. This multi-stakeholder approach aligns with recommendations in the literature for evaluating complex interventions in healthcare settings [110, 111].

A key limitation of this study is the potential for selection bias inherent in quasi-experimental designs. While systematic allocation based on admission order was employed to mitigate this risk, the absence of true randomization may have introduced unmeasured confounding variables. This limitation potentially affects the internal validity of the study, necessitating cautious interpretation of the causal relationships between the intervention and observed outcomes. Future research employing randomized controlled trials could further validate these findings and strengthen causal inferences. However, the study's relatively small sample size limits the generalizability of the findings. While the results are promising, larger-scale studies across multiple sites are needed to validate these findings and ensure their applicability to diverse pediatric populations. Additionally, the potential for selection bias and the Hawthorne effect cannot be ruled out, as participants who volunteered for the study may have been more motivated or open to mindfulness practices than the general population of hospitalized children.

Recommendations for further research

The findings of this study open up several important avenues for future research. Longitudinal studies are needed to assess the long-term effects of mindfulness interventions on children's psychological well-being post-hospitalization. Such studies could help determine whether the benefits observed during hospitalization are sustained over time and potentially influence children's coping strategies in future stressful situations. Larger-scale, multi-center, randomized controlled trials would help validate this study's findings and ensure that the results are generalizable to a broader population of hospitalized children. These studies should include diverse paediatric populations across different medical conditions, socioeconomic backgrounds, and cultural contexts to explore potential moderating factors in the effectiveness of mindfulness interventions.

Future research should also focus on developing and testing age-specific and condition-specific adaptations of mindfulness interventions. Given the observed differences in effectiveness across age groups, tailoring interventions to match children's developmental stages and cognitive abilities could maximize their impact. Similarly, adapting mindfulness practices for children with specific medical conditions or those undergoing particular treatments could enhance their relevance and effectiveness. Exploring technology-assisted mindfulness interventions for hospitalized children represents another promising direction for future research. Digital tools, such as mindfulness apps or virtual reality experiences, could offer flexible and engaging ways for children to practice mindfulness, both during hospitalization and after discharge. Investigating the efficacy of these technology-enhanced approaches compared to traditional mindfulness interventions could provide valuable insights for developing more accessible and sustainable mindfulness programs for paediatric patients.

Implications for policy and practice

The findings of this study have significant implications for both healthcare policy and clinical practice in pediatric settings. At the policy level, there is a strong case for integrating mindfulness-based interventions (MBIs) into standard care protocols for hospitalized children. Healthcare institutions and regulatory bodies should consider developing guidelines incorporating MBIs as a complementary approach to traditional medical care, potentially leading to improved patient outcomes and more holistic care delivery. For practice, the results underscore the need for specialized training programs to equip paediatric nurses with the skills to deliver mindfulness interventions effectively. This may necessitate changes in nursing education curricula and continuing professional development offerings. Furthermore, the study highlights the

importance of tailoring interventions to different age groups and medical conditions, suggesting that hospitals should develop a range of age-appropriate mindfulness tools and techniques. The challenges identified in maintaining engagement during periods of acute distress also indicate a need for flexible implementation strategies that can be adapted to individual patient needs and hospital routines. By adopting these evidence-based practices, healthcare providers can enhance the psychological well-being of hospitalized children, potentially reducing the long-term emotional impact of hospitalization and improving overall health outcomes.

Conclusion

This study provides compelling evidence for the efficacy of nurse-led mindfulness interventions in improving the psychological well-being of hospitalized school-aged children. The significant reductions in stress, anxiety, and mood disturbances, coupled with improved fatigue levels, suggest that mindfulness practices could be a valuable, non-invasive component of paediatric hospital care. The observed age-related differences in intervention effectiveness highlight the importance of developmental considerations in designing mindfulness programs for children. However, the challenges identified in implementing and sustaining mindfulness practices in hospital settings and beyond discharge point to areas requiring further attention and innovation. Successful integration of mindfulness interventions into paediatric healthcare will require addressing these challenges through targeted staff training, flexible intervention protocols, and strategies to support continued practice post-hospitalization. As the field of paediatric mindfulness continues to evolve, further research is needed to refine these interventions, explore their long-term impacts, and investigate how they can be most effectively integrated into comprehensive paediatric care. By building on the promising findings of this study and addressing the identified limitations and challenges, future research can help maximize the potential of mindfulness interventions to enhance the overall well-being of hospitalized children and support their psychological resilience in the face of medical challenges.

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Institutional review board statement

The research protocol received ethical clearance from Jouf University's institutional ethics committee, adhering to the principles outlined in the Helsinki Declaration. The approval was granted on March 19, 2024, with the reference code 4-06-45. To protect participant privacy, various measures were taken, including the use of individual identification codes for each nurse and presenting findings only in consolidated form. All electronic data was securely stored in a password-protected system. Prior to participating in the study via an online Google form questionnaire, nurses provided their informed consent electronically.

Authors' contributions

Conceptualization, N.A. and O.M.E.R.; methodology, formal analysis, O.M.E.R. and N.A.; investigation, O.M.E.R.; resources, N.A., O.M.E.R.; writing original draft preparation, O.M.E.R. Supervision, O.M.E.R.; project administration, N.A. All authors have read and agreed to the published version of the manuscript.

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Data availability

Data will be available upon request.

Declarations

Ethics approval and consent to participate

Informed consent was obtained from all participants involved in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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