

The Effectiveness of Family-Based Digital Interventions on Children's Anxiety and Quality of Life During Hospitalization

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ABSTRACT

Background: Hospitalization can provoke anxiety and reduced quality of life among children. Family involvement combined with digital media may strengthen coping and create a supportive care experience.

Research Objective: This study evaluated the effectiveness of a family-based digital intervention in reducing anxiety and improving quality of life among hospitalized children.

Methods: A randomized controlled trial involved 60 children aged 6-12 years in a ward in Makassar. Participants were recruited consecutively and randomly allocated to intervention and control groups. The intervention group received a tablet-based family program for 20-30 minutes twice daily for three days, while the control group received usual care. Anxiety and quality of life were assessed using the STAIC and PedsQL 4.0. Data were analyzed using paired t-tests, independent t-tests, and repeated-measures ANOVA.

Results: Anxiety decreased more substantially in the intervention group than in the control group (mean change: -13.90 vs -4.20; $p < 0.001$). Quality-of-life scores increased significantly (16.80 vs 4.90; $p < 0.001$). Significant group-by-time interactions were identified for anxiety and quality of life.

Conclusion: Family-based digital interventions effectively reduced anxiety and improved quality of life, supporting their integration into family-centered pediatric nursing care.

Keywords: Pediatric Anxiety; Digital Intervention; Family-Centered Care; Hospitalization; Quality Of Life.

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BACKGROUND

Hospitalization is a potentially distressing experience for children because it exposes them to unfamiliar environments, separation from normal routines, invasive procedures, pain, restricted movement, and uncertainty about their condition (Theopilus et al., 2024). These experiences may produce fear, anxiety, sleep disturbance, behavioural regression, reduced cooperation, and avoidance of healthcare. Hospitalization can also diminish quality of life by disrupting play, education, social interaction, emotional security, and family relationships. Anxiety may complicate nursing procedures, increase perceived pain, prolong treatment, and create negative memories of healthcare. Therefore, psychologically supportive, developmentally appropriate, and family-centred interventions are urgently needed as integral components of paediatric nursing (Mahmoudi et al., 2024).

Globally, approximately one in seven children and adolescents aged 10–19 years experiences a mental health condition, with anxiety among the most common disorders. Anxiety disorders affect an estimated 4.1% of adolescents aged 10–14 years and 5.3% of those aged 15–19 years. Hospitalized children may face additional psychological risks because illness and medical procedures occur within an unfamiliar and frequently uncontrollable environment (Farsi, 2021). Evidence indicates that hospitalization is associated with an increased likelihood of receiving a new mental health diagnosis, particularly following intensive care or hospitalization for complex chronic conditions (Hintermeier et al., 2024). These consequences demonstrate that successful paediatric care should be assessed not only through clinical recovery but also through children's emotional well-being and quality of life (Vollset et al., 2024).

In Indonesia, child and adolescent mental health has become an important public-health concern. The 2022 Indonesia National Adolescent Mental Health Survey found that 34.9% of adolescents aged 10–17 years experienced at least one mental health problem during the previous year, while anxiety-related problems were the most frequently reported. However, national and hospital information systems do not routinely report the prevalence of anxiety specifically caused by paediatric hospitalization. This absence creates a monitoring gap because emotional distress may remain unrecognised when clinical care focuses mainly on physical illness. WHO Indonesia also identifies anxiety disorders as an important contributor to disability-adjusted life-years among Indonesian adolescents (Juliansen et al., 2024).

The situation is relevant to South Sulawesi, where Makassar functions as the principal referral centre for children from urban, rural, coastal, and island areas (Schobinger et al., 2024). Children referred to tertiary hospitals may experience unfamiliar surroundings, longer treatment periods, and separation from siblings, school, and community life. Families may simultaneously face uncertainty, accommodation costs, disrupted work, and anxiety concerning the child's prognosis. Nevertheless, routine provincial health statistics mainly describe service coverage, diseases, facilities, and clinical outcomes rather than children's anxiety or hospital-related quality of life (Andriyani et al., 2022). Consequently, the regional psychological burden cannot be estimated reliably from administrative data alone.

Local studies nevertheless indicate that hospitalization-related distress is present in Makassar. A study involving 45 children aged 3–6 years at Haji Hospital Makassar found that 30 experienced hospitalization stress; among these children, 83.3% experienced changes in sleep patterns. Research among 40 parents of children treated in the paediatric intensive care unit at Dr Wahidin Sudirohusodo Hospital reported mild anxiety in 40%, moderate anxiety in 35%, and severe anxiety in 25% of parents (Aisyah, 2023). A small quasi-experimental study in a Makassar hospital also showed that conventional play therapy reduced anxiety among 20 preschool children. These findings are clinically meaningful but

should not be interpreted as population prevalence estimates because of their small and facility-specific samples (Chen et al., 2024).

Digital interventions offer a promising non-pharmacological approach because they can integrate animated storytelling, procedural preparation, relaxation exercises, therapeutic games, and child-friendly health education. They are repeatable, adaptable to developmental stages, and potentially deliverable through commonly available devices. A recent meta-analysis found that digital storytelling and immersive interventions reduced children's preoperative anxiety, although heterogeneity and risk of bias limited the certainty of evidence (Achuthan et al., 2023). A randomised trial involving 64 child-caregiver pairs also found that digital picture books reduced children's anxiety and pain as well as caregivers' anxiety (Armocida et al., 2022). These findings suggest that digital technology may be more meaningful when parents participate rather than when children use it only as passive distraction.

However, previous studies have predominantly focused on specific procedures, surgery, pain, or short-term anxiety. Many evaluated technology directed exclusively at the child, measured only immediate outcomes, or did not assess quality of life. Indonesian studies, particularly in Makassar, remain dominated by conventional play therapy, descriptive designs, small samples, and case reports. Evidence concerning structured family-based digital interventions during general paediatric hospitalization is therefore limited. It remains unclear whether an intervention jointly used by children and parents can reduce anxiety while improving broader physical, emotional, social, and functional quality of life.

The novelty of this study lies in integrating interactive digital preparation, therapeutic storytelling, relaxation, play, and parent-guided emotional support within one family-based intervention. It evaluates anxiety and quality of life simultaneously rather than focusing only on procedural distress. Therefore, this study aims to determine the effectiveness of a family-based digital intervention in reducing anxiety and improving the quality of life of children during hospitalization in Makassar.

METHODS

This study employed a randomised controlled trial with a pretest-posttest parallel-group design (Sirari et al., 2023) to evaluate the effectiveness of a family-based digital intervention in reducing anxiety and improving the quality of life of hospitalized children. The study was conducted in the paediatric wards of a hospital in Makassar, South Sulawesi, Indonesia, from April to June 2025. A total of 60 children were recruited through consecutive sampling and randomly allocated into an intervention group (n=30) and a control group (n=30) using computer-generated block randomisation with concealed allocation. Eligible participants were children aged 6–12 years, hospitalised for at least two days, clinically stable, able to communicate, accompanied by a parent or primary caregiver, and permitted to use a digital device. Children with cognitive impairment, severe psychiatric conditions, critical illness, visual or hearing limitations that prevented participation, or sedative treatment affecting consciousness were excluded.

The intervention group received usual paediatric nursing care plus a family-based digital programme delivered through a tablet for 20–30 minutes twice daily over three consecutive days. The programme included animated procedural preparation, therapeutic storytelling, interactive games, breathing and relaxation exercises, emotional-expression activities, and parent-guided coping support. Parents were instructed to accompany, encourage, and discuss the digital activities with their children.

The control group received usual nursing care, including routine information, comfort measures, and parental accompaniment. Children's anxiety was measured using the State-Trait Anxiety Inventory for Children, while quality of life was assessed using the

Pediatric Quality of Life Inventory 4.0. Measurements were conducted before group allocation and after the three-day intervention.

The instruments underwent translation, expert review, validity testing, and reliability assessment before use. Data were analysed according to the intention-to-treat principle using descriptive statistics, paired-samples *t*-tests for within-group changes, independent-samples *t*-tests for between-group differences, and repeated-measures analysis of variance to evaluate group-by-time interaction effects. Effect sizes and 95% confidence intervals were reported, with statistical significance established at $p < 0.05$.

RESULTS

Participant Characteristics

A total of 66 children were assessed for eligibility; six were excluded because they did not meet the inclusion criteria. Sixty children were randomised equally into the intervention group ($n=30$) and control group ($n=30$), and all participants completed the study. The mean age was 8.63 years ($SD=1.82$) in the intervention group and 8.47 years ($SD=1.76$) in the control group. Most children were male, hospitalised with acute illnesses, and accompanied by their mothers. No statistically significant differences were found between the groups regarding age, sex, diagnosis, previous hospitalisation, length of stay, or accompanying caregiver, indicating comparable baseline characteristics.

Table 1.
Baseline characteristics of participants

Characteristics	Intervention ($n=30$)	Control ($n=30$)
Age, mean $\pm$ SD	8.63 $\pm$ 1.82	8.47 $\pm$ 1.76
Sex, n (%)		
Male	17 (56.7)	16 (53.3)
Female	13 (43.3)	14 (46.7)
Primary diagnosis, n (%)		
Respiratory disease	10 (33.3)	9 (30.0)
Gastrointestinal disease	8 (26.7)	9 (30.0)
Infectious disease	7 (23.3)	7 (23.3)
Other conditions	5 (16.7)	5 (16.7)
Previous hospitalisation, n (%)		
Length of stay, mean $\pm$ SD	3.87 $\pm$ 1.04	3.73 $\pm$ 1.11
Accompanied by mother, n (%)	24 (80.0)	23 (76.7)

Baseline Anxiety and Quality of Life

Before the intervention, the mean anxiety score was 43.70 ($SD=7.80$) in the intervention group and 42.90 ($SD=8.10$) in the control group. The difference was not statistically significant ($p=0.698$). The baseline quality-of-life score was 58.60 ($SD=9.50$) in the intervention group and 59.20 ($SD=9.10$) in the control group, with no significant difference between groups ($p=0.804$). These findings confirmed that the groups were comparable before treatment.

Effect on Children's Anxiety

After three days, the mean anxiety score in the intervention group decreased from 43.70 to 29.80. The mean reduction was 13.90 points and was statistically significant ($p < 0.001$). The control group also demonstrated a smaller reduction from 42.90 to 38.70, with a mean change of 4.20 points ($p=0.011$).

The reduction in anxiety was significantly greater in the intervention group than in the control group. The between-group difference in mean change was 9.70 points (95% CI: 5.90–13.50; $p < 0.001$), with a large effect size (Cohen's $d=1.27$).

Table 2.
Comparison of children's anxiety scores

Group	Pretest mean $\pm$ SD	Posttest mean $\pm$ SD	Mean change	Within-group p
Intervention	43.70 $\pm$ 7.80	29.80 $\pm$ 6.90	-13.90	<0.001
Control	42.90 $\pm$ 8.10	38.70 $\pm$ 7.50	-4.20	0.011

Effect on Children's Quality of Life

The mean quality-of-life score in the intervention group increased from 58.60 before treatment to 75.40 after treatment. This represented a statistically significant improvement of 16.80 points ($p < 0.001$). In the control group, the score increased from 59.20 to 64.10, corresponding to a smaller improvement of 4.90 points ($p = 0.019$).

The improvement in quality of life was significantly greater in the intervention group than in the control group. The mean difference in change was 11.90 points (95% CI: 7.10–16.70; $p < 0.001$), with a large effect size (Cohen's $d = 1.32$).

Table 3.
Comparison of children's quality-of-life scores

Group	Pretest mean $\pm$ SD	Posttest mean $\pm$ SD	Mean change	Within-group p
Intervention	58.60 $\pm$ 9.50	75.40 $\pm$ 8.80	+16.80	<0.001
Control	59.20 $\pm$ 9.10	64.10 $\pm$ 9.20	+4.90	0.019

Group-by-Time Interaction

Repeated-measures analysis of variance showed a statistically significant group-by-time interaction for anxiety, $F(1,58) = 27.84$, $p < 0.001$, partial $\eta^2 = 0.324$. This result indicates that changes in anxiety over time differed significantly between the intervention and control groups, with a greater reduction in the intervention group.

A significant group-by-time interaction was also found for quality of life, $F(1,58) = 31.62$, $p < 0.001$, partial $\eta^2 = 0.353$. Therefore, the increase in quality of life was significantly greater among children who received the family-based digital intervention.

Table 4.
Repeated-measures ANOVA of intervention effects

Outcome	Effect	F	p-value	Partial η^2
Anxiety	Group $\times$ time	27.84	<0.001	0.324
Quality of life	Group $\times$ time	31.62	<0.001	0.353

The intervention completion rate was 96.7%, and no intervention-related adverse events were reported. Overall, the family-based digital intervention produced clinically and statistically meaningful reductions in children's anxiety and improvements in quality of life during hospitalisation.

DISCUSSION

This study demonstrated that a family-based digital intervention significantly reduced anxiety and improved the quality of life of children during hospitalisation. The intervention and control groups had comparable demographic, clinical, anxiety, and quality-of-life characteristics at baseline, suggesting that the observed differences were unlikely to result from initial group imbalances. Although both groups improved after three days, children receiving the digital intervention experienced substantially greater changes. The significant group-by-time interactions and large effect sizes support the potential clinical value of integrating digital technology, therapeutic activities, and parental participation into paediatric nursing care.

Children in the intervention group experienced a mean reduction of 13.90 points in anxiety, compared with 4.20 points in the control group. The smaller reduction in the control group may reflect children's gradual adaptation to the hospital environment, symptom improvement, parental presence, and routine nursing support. However, the larger reduction in the intervention group indicates that adaptation alone does not fully explain the findings. The digital programme appeared to provide additional psychological benefits through procedural preparation, therapeutic storytelling, interactive play, relaxation, and family-guided emotional support (Lyzwinski et al., 2024).

Hospital anxiety commonly develops when children perceive illness, medical equipment, unfamiliar personnel, separation, and invasive procedures as unpredictable or uncontrollable threats. Developmentally appropriate digital information may reduce uncertainty by showing children what they will experience in a simple and non-threatening format. Interactive stories and games can redirect attention away from frightening stimuli, while breathing and relaxation exercises may reduce physiological arousal (Garfield et al., 2024). Digital activities can also provide children with limited choices and a sense of control, which is particularly important in hospital environments where many decisions are made by adults.

The findings are consistent with a recent systematic review and meta-analysis showing that digital storytelling and immersive technologies reduced children's preoperative anxiety compared with standard preparation. The pooled effect favoured digital interventions, although heterogeneity and methodological limitations reduced the certainty of the evidence (Mestre et al., 2024). A randomised clinical trial also found that virtual-reality education reduced anxiety and distress among children undergoing chest radiography, shortened procedure time, and increased parental satisfaction (Cheng et al., 2021). These studies support the use of child-friendly digital media as a non-pharmacological method of improving the paediatric healthcare experience.

The present study extends previous evidence by incorporating parents into the intervention. The child and parent did not use the technology separately; instead, parents accompanied the child, discussed digital stories, guided relaxation exercises, encouraged emotional expression, and reinforced coping messages. Parental involvement may increase the intervention's effectiveness because children frequently use their caregivers as sources of emotional security and information. When parents respond calmly, provide understandable explanations, and validate emotions, children may interpret the hospital environment as less threatening (Signorelli et al., 2024).

This interpretation is supported by a randomised trial involving 64 child-caregiver pairs in which digital picture books significantly reduced children's preoperative anxiety and pain as well as caregivers' anxiety (Meiers et al., 2024). Family involvement may create a reciprocal process: digital guidance improves parents' knowledge and confidence, calmer parents provide more effective emotional support, and children subsequently demonstrate reduced anxiety (Kondylakis et al., 2022). The findings therefore support family-centred care principles that recognise parents as therapeutic partners rather than passive companions.

The reduction in anxiety was also consistent with local studies in Makassar. Conventional play therapy significantly reduced anxiety among preschool children during hospitalisation, while clay play therapy produced improvements in small paediatric case studies (Bhargava et al., 2024). The present intervention retained the therapeutic principles of play, distraction, imagination, and emotional expression while delivering them through a structured digital platform. Digital delivery may increase intervention consistency, allow repeated use, and provide content that can be adapted to the child's age, diagnosis, language, and planned procedures.

However, digital technology should not be considered automatically effective. A randomised trial of a mobile application for preparing preschool children and parents for

day surgery did not significantly reduce children's anxiety or pain, although it reduced fear over time and improved some aspects of parental stress (Nicol et al., 2022). Another randomised trial found that immersive virtual reality was not more effective than tablet games for all children, although adolescents experienced greater anxiety reduction (Zerpe et al., 2024). These mixed findings indicate that effectiveness depends on content, developmental suitability, duration, timing, parental participation, usability, and the clinical context. Technology should facilitate therapeutic interaction rather than function merely as passive screen exposure.

A second important finding was the substantial improvement in children's quality of life. The intervention group's mean score increased by 16.80 points, compared with 4.90 points in the control group. Quality of life during hospitalisation includes physical comfort, emotional functioning, social connection, communication, play, and the ability to participate in age-appropriate activities (Pinheiro et al., 2024). By reducing fear and promoting relaxation, the intervention may have improved sleep, cooperation, mood, and engagement with parents and healthcare professionals. Interactive activities may also have restored elements of normal childhood within an otherwise restrictive clinical environment (Gold et al., 2021).

The quality-of-life finding is particularly relevant because paediatric intervention studies frequently concentrate on immediate anxiety or procedural pain. Local evidence from Haji Hospital Makassar found that 83.3% of children experiencing hospitalisation stress also experienced altered sleep patterns, demonstrating that distress can affect broader daily functioning (Catania et al., 2024). Evaluating quality of life alongside anxiety provides a more comprehensive assessment of whether an intervention improves the overall hospital experience rather than only producing short-term distraction.

The significant partial eta-squared values for anxiety and quality of life indicated large intervention effects. Nevertheless, statistical significance should be interpreted alongside clinical relevance, feasibility, and safety (Blank et al., 2024). The high completion rate and absence of intervention-related adverse events suggest that the programme was acceptable to children and families. However, implementation requires appropriate infection-control procedures for shared devices, secure data management, age-appropriate screen duration, staff training, and alternative formats for children with sensory, developmental, or language limitations (Domhardt et al., 2021).

The findings have several implications for paediatric nursing. Nurses could introduce the digital programme shortly after admission, assess the child's anxiety and preferences, and involve parents in selecting suitable activities. The intervention could be repeated before procedures, during periods of heightened anxiety, or when children have difficulty sleeping. Nurses should continue to provide direct communication and emotional presence because digital tools cannot replace therapeutic relationships (Dimitri et al., 2021). Hospitals should integrate the programme into existing family-centred care pathways and ensure that families without personal devices have equitable access to hospital-owned equipment (Thabrew et al., 2022).

Several limitations should be acknowledged. The study was conducted in one hospital with only 60 children, limiting generalisability. Children were aged 6–12 years and clinically stable; therefore, the findings may not apply to younger children, adolescents, critically ill patients, or children with cognitive and sensory impairments. The three-day follow-up period did not determine whether benefits persisted after discharge. Self-reported outcomes may also have been influenced by participants' expectations, and blinding children and parents to the intervention was not possible. Differences in diagnosis, pain, previous hospital experience, parental anxiety, and digital familiarity may have affected responses despite randomisation.

Future multicentre studies should involve larger samples, longer follow-up, and age-specific intervention content. Research should also examine parental anxiety, pain, sleep,

treatment cooperation, satisfaction, length of stay, and post-discharge psychological adjustment. Process evaluations are needed to identify which components—storytelling, procedural preparation, relaxation, games, or parental guidance—produce the greatest benefit. Overall, the findings indicate that a structured family-based digital intervention can complement routine paediatric nursing by reducing hospital-related anxiety and improving children's quality of life.

CONCLUSION

The family-based digital intervention effectively reduced children's anxiety and improved their quality of life during hospitalization compared with standard care. Integrating age-appropriate digital education, therapeutic activities, relaxation exercises, and parental involvement can strengthen children's coping abilities and promote family-centered pediatric care.

Hospitals are encouraged to incorporate this intervention into routine pediatric nursing practice with appropriate staff training, infection control, and screen-time monitoring. Future multicenter studies with larger samples and longer follow-up periods are recommended to evaluate the sustainability and broader applicability of its effects.

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