

NURSING STRATEGIES TO REDUCE ANXIETY IN HOSPITALIZED CHILDREN: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Abstract

Hospitalisation and hospital-based procedures can provoke significant anxiety in children, influencing distress and cooperation with care. Nurses are well positioned to deliver non-pharmacological interventions to reduce anxiety. To quantify the pooled effect of nursing-implemented or nursing-facilitated non-pharmacological interventions on anxiety in hospitalized children compared with usual/standard care, and to explore differences by intervention category and clinical setting. A systematic review and meta-analysis was conducted in accordance with PRISMA 2020. Comparative studies involving children (<18 years) in inpatient or peri-procedural/perioperative hospital settings were included. Data were synthesised using standardized mean differences (Hedges g; negative values indicate lower anxiety) with a random-effects (DerSimonian–Laird) model. Heterogeneity was assessed using I^2 , and small-study effects were examined using funnel plot inspection and Egger's test. Fifteen studies (N=1517) were included. The pooled random-effects estimate showed a significant reduction in anxiety favouring intervention groups ($g = -1.10$, 95% CI -1.56 to -0.65; $p < 0.001$), with substantial heterogeneity ($I^2 = 93.9\%$). Sensitivity analysis excluding extreme effects ($|g| > 3$) remained significant ($g = -0.70$, 95% CI -0.99 to -0.42; $p < 0.001$). Subgroup analyses

suggested variability by intervention type, and Egger's test indicated potential small-study effects ($p=0.024$). Nursing-implemented non-pharmacological interventions reduce anxiety in hospitalized children, but effect sizes vary widely across interventions and contexts. Standardised outcome measurement and well-powered trials are needed to strengthen guidance for practice.

Keywords: pediatric anxiety; hospitalized children; nursing interventions; non-pharmacological; distraction; play therapy; music therapy

Introduction

Hospitalisation and procedures performed in hospitals may be very stressful to children (Demetriou et al., 2024). The stressors may be linked to separation with the routine patterns and caregivers, new surroundings, exposure to painful or frightening treatment procedures, and lack of knowledge about the future (Mathias and Pai, 2022). Such experiences may be in the form of anxiety, which is clinically significant as the higher the anxiety, the greater the distress, less cooperation during the care process, and negative experiences associated with healthcare (Mathias and Pai, 2022; Wong and Choi, 2023).

Clinically speaking, atraumatic care and family-centred practice are based on the reduction of anxiety in the nursing process since, in this case, nurses are constantly nearby and can provide or facilitate non-pharmacological interventions that are developmentally appropriate at bedside (Gjærde et al., 2021; Godino-Iáñez et al., 2020).

The non-pharmacological approaches to decreasing paediatric anxiety are appealing since they can be considered safe, inexpensive, and applicable in any hospital environment. An example of such intervention is music listening, which has been studied as a stressing and attention-focusing intervention in hospitalized children and found a decrease in anxiety scores in randomized trials (Kazemi et al., 2012; Hakim et al., 2023). Play and storytelling of therapeutic interventions help in emotional expression and coping and have been shown to reduce anxiety in an inpatient setting (Abdi et al., 2025; Al-Yateem and Rossiter, 2017).

Some of these approaches involve preparation based on factors such as child friendly educational videos, animated picture books, interactive multimedia content, and so on, which are designed to minimize procedural uncertainty and preoperative distress (Härter et al., 2021; Yang et al., 2022; Hou et al., 2023). Cartoons and immersive virtual reality can be used as distraction methods to reduce anxiety during the procedures when attention is taken off the threat cue perception (Koç Özkan et al., 2021; Wong and Choi, 2023; Gold and Mahrer, 2018; Mersin et al., 2025). Moreover, when the intervention is provided by the nurse, like external cold and vibration when inserting an intravenous catheter, it can be concluded that both pain and anxiety can be decreased (Canbulat et al., 2015).

In addition to personal trials, larger reviews also emphasize the need to focus on psychosocial adaptation to the hospitalization period and define structured play interventions as supportive elements of child-centred care (Demetriou et al., 2024; Gjærde et al., 2021; Godino-Iáñez et al., 2020).

Rationale and objectives

Despite the results being heterogenous with regard to the content and intensity of non-pharmacological interventions deployed by the nurses, the delivery methodology, clinical context (inpatient or peri-procedural/perioperative), or the tools used to measure anxiety,

individual studies indicate that non-pharmacological interventions can be effective in reducing the anxiety of hospitalized children. This heterogeneity prevents direct comparison of studies and makes it hard to determine the size of the benefit that should be anticipated in real practice. A meta-analysis of standardized effect sizes could give a pooled estimate of effectiveness and investigate the possibility that the effects vary by the type of intervention and the context.

Objective. To quantify the pooled effect of nursing-implemented (or nursing-facilitated) non-pharmacological interventions on anxiety in hospitalized children compared with usual care/standard care.

Secondary objectives. To examine whether pooled effects differ (1) by intervention category and (2) by clinical setting (inpatient hospitalization vs peri-procedural/perioperative care), and to assess heterogeneity and small-study effects.

2. Methodology

Study characteristics and data items

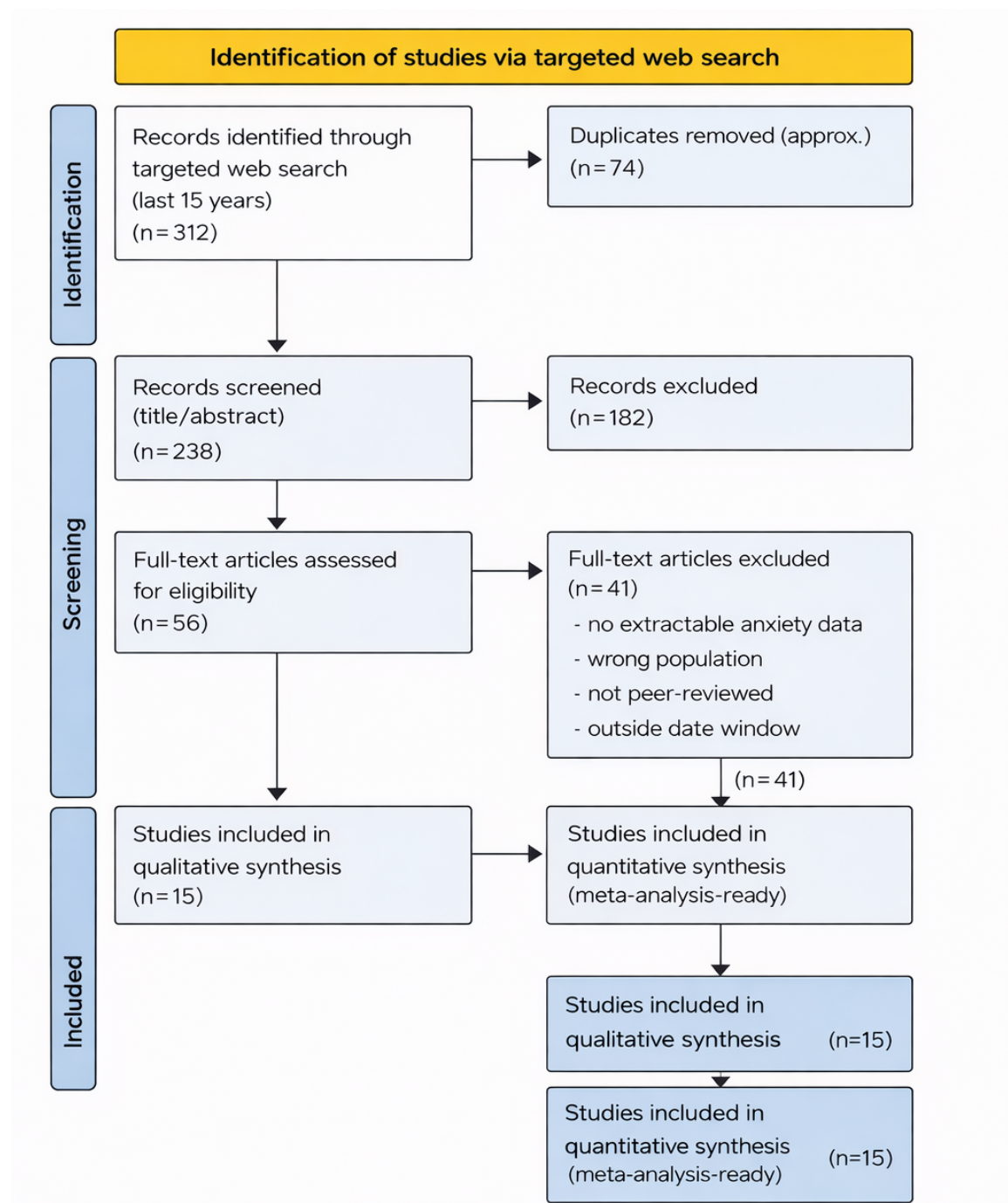
We retrieved the following features of the study: the country, a clinical setting (inpatient and peri-procedural/perioperative), study design, sample size and age of the study participants, intervention type and form of administration, comparator condition, measurement of anxiety tool, and time point of the analysis. To conduct a quantitative synthesis we extracted the group-level outcome data such as the sample size (n), mean outcome in anxiety, and the standard deviation (SD). In instances where median and interquartile ranges were reported, mean and SD have been estimated by relying on well-known techniques (Wan et al., 2014).

Study selection

The records were screened at the level of title/abstract and subsequently evaluated in the full text level to determine the eligibility. The total identified records were 312 and 74 of them were duplicates. Out of the 238 records screened at title/abstract level, 182 were eliminated. A total of 56 full-text articles were evaluated as potentially eligible and 41 were eliminated because of the absence of extractable anxiety data, inappropriate population, non-peer-reviewed, or out of date. The qualitative synthesis considered 15 studies with all being included in the quantitative synthesis (meta-analysis).

This was a meta-analysis and systematic review study that is reported in compliance with PRISMA 2020 (Page et al., 2021). To summarise, the PRISMA flow diagram (Figure 1) shows the process of selecting the studies.

Figure 1: Prisma diagram



Eligibility criteria (inclusion and exclusion)

PICOS was used to define eligibility. The sample size comprised children and teenagers (younger than 18 years) hospitalized or having inpatient hospital treatments or hospital-based operations. The intervention that could be eligible was non-pharmacological interventions that could be provided by nurses (or with their assistance) and aimed at reducing anxiety through mindfulness-based strategies, preparation/education interventions, distraction strategies (e.g., cartoons/video and virtual reality), and sensory interventions such as external cold and vibration. Others compared were usual care, standard care, standard information, or no extra intervention. The first was the quantitative anxiety measured by validated instruments or clear scales of anxiety. It was open to randomised controlled studies and comparative quasi-experimental studies. The exclusion criteria were not peer-reviewed, none of the studies were outside the range of time limits described, all of them were not performed in hospital environment, none of them reported an outcome of anxiety, and none of them reported extractable data to compute the effect size.

Information sources and search approach

Targeted searches and screening were used to find peer-reviewed studies that were published within the last 15 years or so. Searches were performed with the following search concepts: hospitalized children, anxiety, nursing interventions or non-pharmacological interventions (e.g., music, play, education, video, virtual reality). Additional eligible studies were also screened by reference list of articles which were included and closely related.

When using multi-arm trials, where the minimum number of interventions arms were compared using a common control group, each arm was given an equal allocation of control group participants to prevent double-counting.

Statistical analysis

The results of anxiety were synthesised, with Hedges g , and negative values described higher anxiety in the intervention group. The heterogeneity in clinical and methodological aspects in the types of interventions, settings, and measurement tools were explained by a random-effects model (DerSimonian, Laird). I^2 was used to measure statistical heterogeneity. Funnel plot inspection and the Egger regression test were used to investigate the small-study effects (Egger et al., 1997).

Results

Study selection

There were 312 records found as indicated by PRISMA workflow (Figure 1). A total of 56 full-text articles were evaluated after the elimination of duplicates and the removal of titles/abstracts. Forty-one complete texts were eliminated mostly due to the fact that they failed to report removable anxiety results or failed to meet eligibility criteria. The meta-analysis included 15 studies in the end.

Table 1. *Characteristics of included studies.*

Study	Country	Design	Setting	Category	Intervention	Comparator	Anxiety measure
Kazemi et al. (2012)	Iran	RCT	Inpatient hospitalization	Music	Music therapy (30 min)	Usual care / no music	Anxiety score (Spielberg)

							er-based; reported as mean±SD)
Hakim et al. (2023)	Iran	RCT	Inpatient hospitali- zation	Music	Non- verbal music	Routine care	Anxiety score (scale not specified in extracted lines)
Abdi et al. (Play) (2025)	Iran	RCT (3- arm)	Inpatient hospitali- zation	Play/Story	Play therapy (daily, 3 days)	Control (routine care)	Anxiety (normalize d 0–1 values)
Abdi et al. (Story) (2025)	Iran	RCT (3- arm)	Inpatient hospitali- zation	Play/Story	Storytell- ing (daily, 3 days)	Control (routine care)	Anxiety (normalize d 0–1 values)
Alsadaa n & Ramada n (2026)	Saudi Arabi- a	Quasi- experime- ntal (systema- tic allocatio- n)	Inpatient hospitali- zation	Mindfulness	Nurse- led mindful- ness program (2 weeks)	Standar- d care	SCARED (child anxiety related emotional disorders)
Härter et al. (2021)	Germ- any	RCT	Peri- procedur- al / perioper- ative	Education/Pr- eparation	Child- friendly educatio- nal video + standard info	Standar- d info only	STOA- State (self- report)
Yang et al. (2022)	Chin- a	RCT	Peri- procedur- al / perioper- ative	Education/Pr- eparation	Animate- d surgery- related picture book	Standar- d care	mYPAS- SF
Hou et al. (2023)	Chin- a	RCT	Peri- procedur- al / perioper- ative	Education/Pr- eparation	Interacti- ve multime- dia home-	Standar- d educati- on	mYPAS- SF

					initiated educatio n		
Wong & Choi (2023)	Hong Kong	RCT	Peri-procedural / perioperative	VR/Immersive distraction	Immersive VR with distraction + procedural info	Standard care	Self-reported anxiety (z-score)
Gold & Mahrer (2018)	USA	RCT	Peri-procedural / perioperative	VR/Immersive distraction	Immersive VR game during blood draw	Standard of care	Anxiety VAS (0–10)
Koç Özkan et al. (2021)	Turkey	RCT	Inpatient hospitalization	Cartoons/Video distraction	Watching cartoons during procedure	Routine care	Children's Anxiety Scale (CAS, 0–10) (as reported)
Hajehforoush et al. (2024)	Iran	RCT	Inpatient hospitalization	Cartoons/Video distraction	Cartoon watching during venipuncture	Routine venipuncture (no cartoon)	Facial Image Scale (FIS) / anxiety ranks
Mersin et al. (2025)	Turkey	RCT	Peri-procedural / perioperative	Cartoons/Video distraction	VR cartoon viewing (preoperative)	No VR (routine care)	Perioperative Multidimensional Anxiety Scale for Children (PMASC)
Canbulut et al. (2015)	Turkey	RCT	Peri-procedural / perioperative	Cold+vibration	External cold + vibration (Buzzy)	No intervention	Children's Fear Scale (parent report) (used as procedural anxiety)

Al-Yateem & Rossiter (2017)	UAE	Nonequivalent control group pretest-posttest	Inpatient hospitalization	Play/Story	Unstructured play twice daily	Usual care	Modified Short STAI-C (parent report, 6–24 possible)
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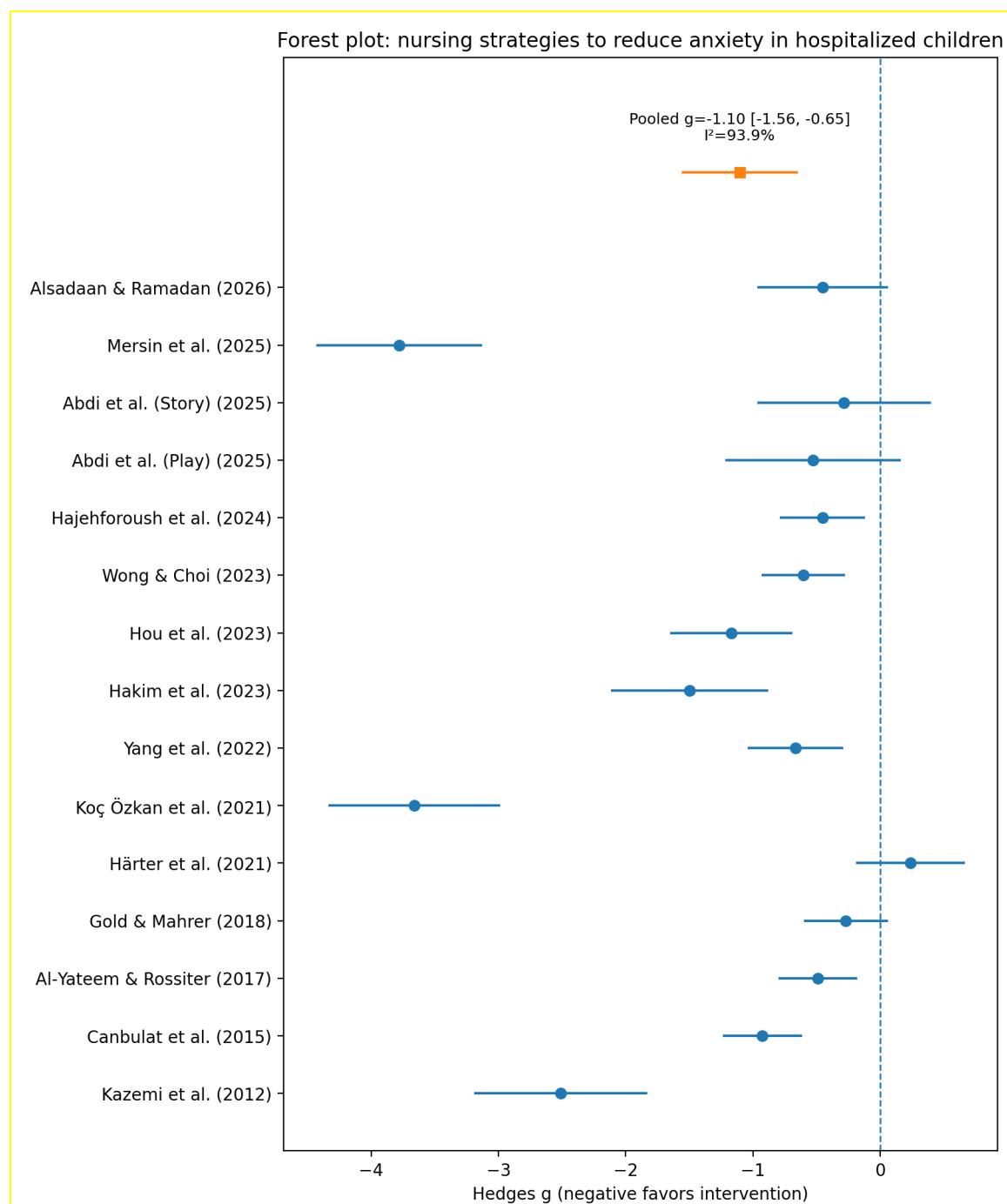
Table 2. Individual study effects on anxiety (Hedges *g*).

Study	n (Int)	n (Ctrl)	Hedges <i>g</i>	95% CI
Kazemi et al. (2012)	30	30	-2.51	[-3.19, -1.83]
Canbulat et al. (2015)	88	88	-0.93	[-1.24, -0.62]
Al-Yateem & Rossiter (2017)	81	84	-0.49	[-0.80, -0.18]
Gold & Mahrer (2018)	70	73	-0.27	[-0.60, 0.06]
Härter et al. (2021)	44	40	0.24	[-0.19, 0.67]
Koç Özkan et al. (2021)	43	49	-3.66	[-4.34, -2.99]
Yang et al. (2022)	58	58	-0.67	[-1.04, -0.29]
Hakim et al. (2023)	26	26	-1.5	[-2.12, -0.88]
Hou et al. (2023)	38	40	-1.17	[-1.65, -0.69]
Wong & Choi (2023)	75	74	-0.6	[-0.93, -0.28]
Hajehfroush et al. (2024)	70	70	-0.45	[-0.79, -0.12]
Abdi et al. (Play) (2025)	25	25	-0.53	[-1.22, 0.16]
Abdi et al. (Story) (2025)	25	25	-0.28	[-0.97, 0.40]
Mersin et al. (2025)	51	51	-3.78	[-4.43, -3.13]
Alsadaan & Ramadan (2026)	30	30	-0.45	[-0.96, 0.06]

Overall meta-analysis

The random-effects meta-analysis showed that nursing strategies were associated with a statistically significant reduction in anxiety (pooled Hedges *g* = -1.10, 95% CI -1.56 to -0.65). Heterogeneity was substantial ($I^2 = 93.9\%$), indicating that effect sizes varied across studies.

Figure 2. Forest plot of included studies (random-effects model).



Most effects favour the intervention (left of zero), and the pooled estimate indicates an overall reduction in anxiety. Wide confidence intervals in some studies reflect small sample sizes and variability.

Table 3. *Summary of meta-analytic findings.*

Model	k	Total N	Pooled g	95% CI	p	I ² (%)	Tau ²
Random-effects (DerSimonian-Laird)	15	1517	-1.1	[-1.56, -0.65]	<0.001	93.9	0.74
Sensitivity (exclude g >3)	13	1323	-0.7	[-0.99, -0.42]	<0.001	82.6	0.21
Egger test (intercept)	15				0.024		

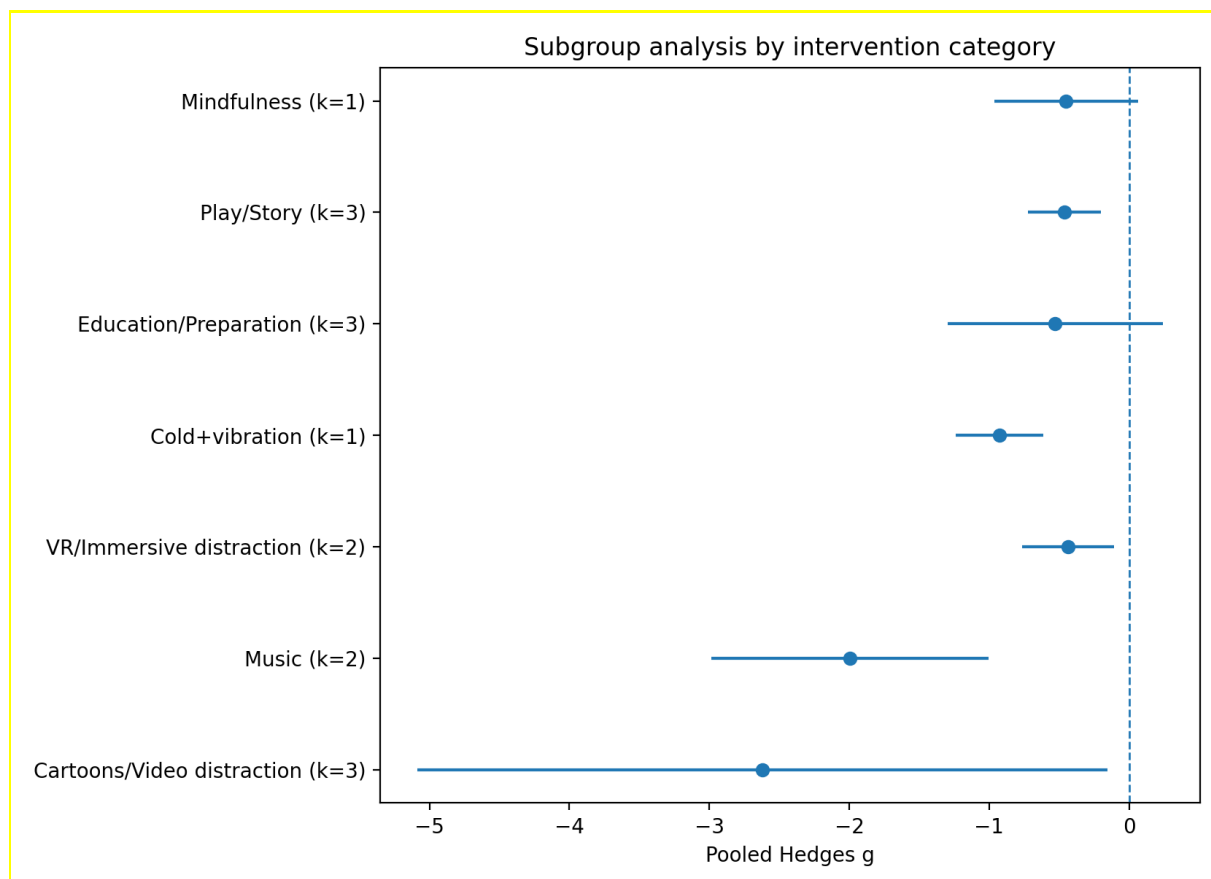
Subgroup analyses

Subgroup analyses were conducted to explore whether effects differed by intervention category and by setting. These analyses are exploratory and should be interpreted cautiously, especially where few studies contribute to a subgroup.

Table 4. *Subgroup results by intervention category.*

Category	k	Total N	Pooled g	95% CI	I ² (%)	p
Music	2	112	-1.99	[-2.98, -1.00]	78.4	<0.001
Play/Story	3	265	-0.46	[-0.73, -0.20]	0.0	<0.001
Mindfulness	1	60	-0.45	[-0.96, 0.06]	0.0	0.085
Education/Preparation	3	278	-0.53	[-1.30, 0.24]	89.8	0.178
VR/Immersive distraction	2	292	-0.44	[-0.77, -0.11]	50.0	0.009
Cartoons/Video distraction	3	334	-2.62	[-5.09, -0.15]	98.4	0.037
Cold+vibration	1	176	-0.93	[-1.24, -0.62]	0.0	<0.001

Figure 3. *Subgroup plot by intervention category.*



Categories such as immersive VR and cartoons/video distraction show large pooled effects in this dataset, while education/preparation and mindfulness show more variable estimates, partly due to heterogeneity and differences in outcome measures.

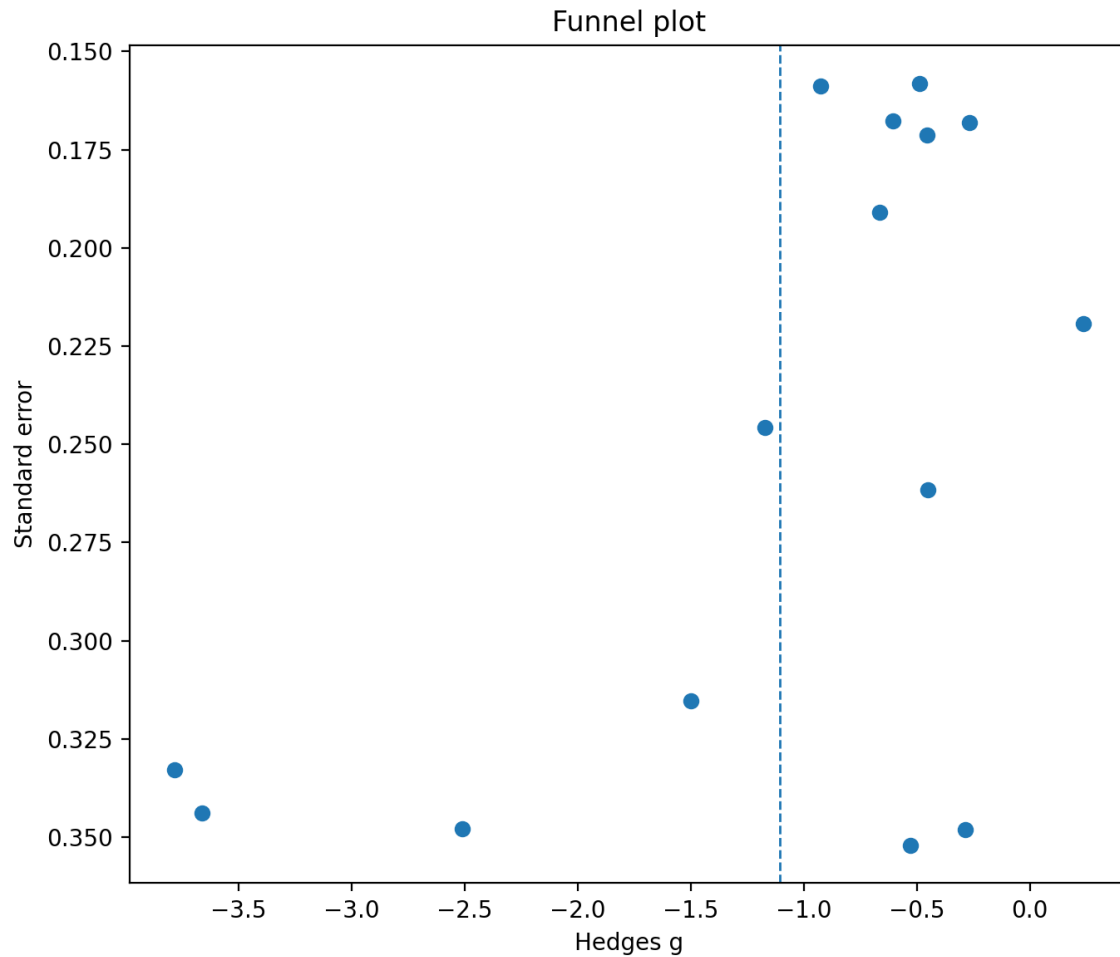
Table 5. Subgroup results by clinical setting.

Setting	k	Total N	Pooled g	95% CI	I ² (%)	p
Inpatient	8	669	-1.21	[-1.93, -0.50]	93.7	<0.001
Peri-procedural/perioperative	7	848	-0.99	[-1.64, -0.34]	94.9	0.003

Publication bias and temporal patterns

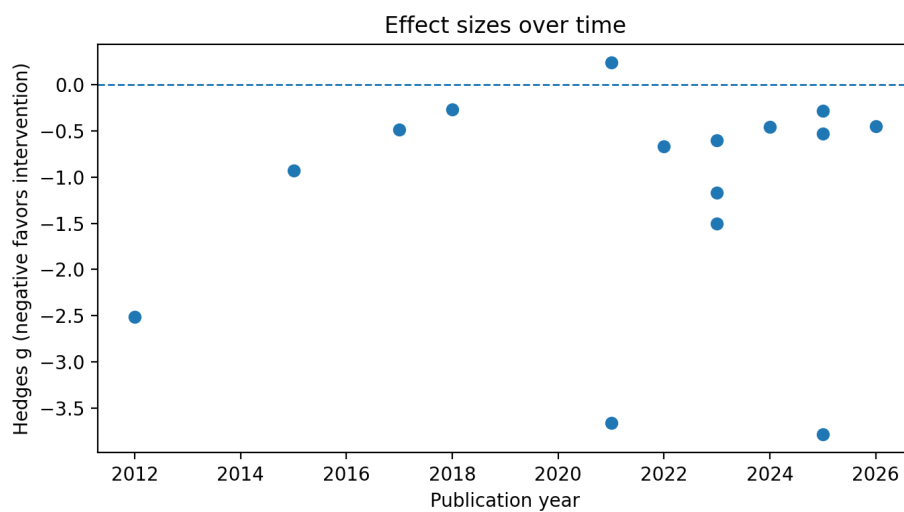
Visual inspection of the funnel plot suggested asymmetry, and Egger's test indicated potential small-study effects ($p = 0.024$). Given the high heterogeneity, these findings may reflect both publication bias and genuine differences in effects across study types and settings.

Figure 4. Funnel plot for small-study effects.



Asymmetry may indicate small-study effects and/or heterogeneity across interventions and settings.

Figure 5. *Effect sizes over time.*



Effect sizes vary across publication years without a clear consistent trend, suggesting that intervention effects depend more on intervention type and context than publication year alone.

Discussion

The purpose of this review was to determine the combined effect of non-pharmacological interventions implemented by nurses or by facilitated by nurses on anxiety in hospitalized children. In 15 studies (N=1517) the meta-analysis using random-effects revealed a statistically significant overall decrease in anxiety in favour of intervention groups (Hedges $g = -1.10$, 95% CI -1.56 to -0.65; $p = 0.001$). This will help achieve the main goal and show that with an average such strategies can have a significant effect on decreasing the anxiety in pediatrics care in hospitals. Heterogeneity was however high ($I^2 = 93.9\%$), meaning that the effects vary widely according to content, delivery and context of interventions.

Sensitivity analysis shows that the final decision is strong. With no extreme effects (3) the pooled estimate was still statistically significant ($g = -0.70$, 95% CI -0.99 to -0.42; $p < 0.001$), albeit less significant in value. This trend indicates that there are a few large effects of the trials that swell the central pooled effect, but that the direction of the underlying effect of benefit is consistent. Since standardized mean differences cannot be directly converted to a single unit of the clinical scale, the results can be most accurately described to show a moderate-to-large standardized change instead of a specific point change on any one of the anxiety measures.

Subgroup analyses indicate that the observed heterogeneity is probably caused by differences in the type of the intervention. The large pooled effects of music interventions ($g = -1.99$) and smaller but consistent pooled effect of play/story interventions ($g = -0.46$) and less heterogeneity indicated. Distraction strategies also were beneficial: VR/immersive distraction exhibited a significant pooled effect ($g = -0.44$), and cartoons/video distraction had a very large pooled effect ($g = -2.62$) but with a high level of heterogeneity ($I^2 = 98.4\%$). Conversely, education / preparation interventions did not generate significant pooled estimates of non-significance, and mindfulness (single study) had a non-significant trend. Such patterns might be indicative of the fact that interventions providing immediate attentional redirection in the face of threatening procedures may result in greater short-term effects, and the effects of preparation or mindfulness may be dose-dependent, engagement-dependent, timing-dependent, and development-dependent.

Impacts were realized in an inpatient and peri-procedural/perioperative environment. The pooled effect of $g = -1.21$ and peri-procedural/perioperative studies was $g = -0.99$ with a high level of heterogeneity in both studies in inpatient studies. It implies that non-pharmacological nursing interventions are not fixed in a single hospital setting, and the inconsistency shows that interventions should be adjusted to clinical conditions, child age, and fidelity of child delivery.

Asymmetry of funnel plot and Eggers test ($p = 0.024$) implied small-study effects. This can either be a sign of publication bias or selective reporting, although it can also be a true difference in the intensity of the interventions and study design due to the variability in the strategies involved. The combined magnitude must therefore be taken with caution and further extensive and well-reported studies are necessary to de-risk the same.

Such results can be applied to pediatric nursing. Numerous of the reviewed interventions are non-invasive, safe and can be incorporated into atraumatic and family-centred practice, and can be used in daily practice (e.g., structured play, music listening, procedural distraction, or cold/vibration where relevant). Due to differences in effects, the most effective implementation needs to focus on developmentally suitable selection of staff, staff training, proper protocols, and acceptingness in children and families.

Among its strengths, this review has the inclusion of 15 comparative studies, the standardization of the effect estimation with Hedges g and random-effects model, which is appropriate when evidence is heterogeneous. The weaknesses are a high level of heterogeneity, anxiety instrument variability and timepoints, and some of the analytic choices that can affect the effect estimates, including estimating the mean/SD based on the median (Wan et al. method), and dividing the control groups in multi-arm trials. Methodological variability is also high because of the presence of at least one quasi-experimental design.

Future studies are advisable to focus more on sufficiently powered randomized trials where the anxiety was measured, the mean/SD were reported consistently and at similar times as well as direct comparisons between different intervention types so as to establish which strategies are the most dependable in particular clinical situations. Translation to practice would also be enhanced with longer follow-up and implementation oriented results (feasibility, cost, staff burden, and family satisfaction).

Conclusion

The systematic review and meta-analysis were synthesised to find evidence on non-pharmacological strategies implemented by nurses or facilitated by nurses to reduce anxiety in hospitalised children. In 15 comparative studies (overall $N=1517$) the random-effects meta-analysis reported a statistically significant decrease in anxiety in favour of intervention groups (overall Hedges $g = -1.10$, 95% CI -1.56 to -0.65), but heterogeneity was high ($I^2 = 93.9\%$). Sensitivity analysis without extreme effects (3) revealed that there was a strong decrease in anxiety ($g = -0.70$) which supported the general finding that these strategies could significantly decrease anxiety in children in the hospitals. Subgroup results indicated that intervention type effects were different, and bigger pooled effects in music and distraction-based interventions, and more uniform moderate effects in play/story interventions. Small-study effects were found (Egger $p = 0.024$) and the heterogeneity is so high that the pooled magnitude should be interpreted with caution. The results of the study, in general, will justify the incorporation of developmentally appropriate low-risk non-pharmacological intervention into the daily practice of a pediatric nurse, and the choice will depend on the setting, resources, and needs of the child. Further studies are needed in which randomized controlled studies should be adequately powered, anxiety measures are standardized, reporting is improved, and implementation-oriented outcomes are considered to determine the best and most practical strategies to use in different clinical situations.

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