Journal of Pediatric Nursing 87 (2026) 1–10

Contents lists available at ScienceDirect

Journal of Pediatric Nursing

journal homepage: www.pediatricnursing.org

# Development and evaluation of an educational picture book targeted at perioperative psycho-behaviors among children undergoing tonsillectomy and adenoidectomy: A mixed-method study

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ARTICLE INFO

*Article history:*
Received 29 September 2025
Revised 22 December 2025
Accepted 23 December 2025

*Keywords:*
Operation
Reading therapy
Resilience
Tonsillectomy and adenoidectomy

ABSTRACT

*Purpose:* This study developed an educational picture book for pediatric patients aged 6–12 undergoing tonsillectomy and/or adenoidectomy (T&A) and evaluated its effectiveness in reducing perioperative psycho-behavioral responses.

*Design and methods:* Phase 1 used qualitative methods, including field observations, interviews with children, parents, and healthcare providers, and expert consultations, to inform the book's development. A multidisciplinary team incorporated elements promoting psychological well-being and coping skills into the storyline. In Phase 2, a non-randomized controlled study was conducted at a tertiary hospital from July to September 2022, involving 68 children. The intervention group read the picture book depicting a child protagonist using positive coping strategies during T&A, while the control group received standard care.

*Results:* Outcomes included resilience, preoperative anxiety, anesthetic compliance, anesthesia emergence delirium, post-hospitalization behavioral changes, and acceptability, measured from the preoperative visit through one month postoperatively. Compared with controls, the intervention group showed significantly lower anxiety ($p < 0.001$), better anesthetic compliance ($p < 0.05$), higher resilience ($p < 0.05$), fewer cases of anesthesia emergence delirium ($p < 0.05$), and fewer behavioral changes three days after surgery ($p < 0.05$). No significant group differences were observed at one month ($p > 0.05$). The picture book demonstrated high acceptability, with a mean liking score of 9.56 out of 10.

*Conclusion:* The findings indicate that the picture book effectively helps prevent perioperative psycho-behavioral problems in pediatric T&A patients.

*Practice implications:* The picture book provides a feasible, child-friendly educational tool that healthcare providers can integrate into routine perioperative care.

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## Introduction

Tonsillectomy and adenoidectomy (T&A) are one of the most common surgical procedures in children to address recurrent tonsillitis and obstructive sleep disorders, and over 600,000 T&As are performed annually worldwide (Fang & Ying, 2020). Children undergoing surgical procedures often experience psychological and behavioral changes. They tend to become anxious, fear "masked" healthcare providers (HCPs), feel uncertainty regarding "sleep" (anesthesia), and experience physical discomfort resulting from prolonged fasting and thirst (Fortier et al., 2010). Previous studies indicated that severe preoperative anxiety occurred in 50 %–75 % of pediatric patients (Fortier et al., 2010), and the preoperative anxiety and stress might lead to long-term psychological trauma in children(Qiu et al., 2022). Evidence also showed that 67 % of pediatric patients exhibited behavioral issues on the second day post-surgery, including eating disturbance and separation anxiety (Kain et al., 1999). Therefore, addressing psychological and behavioral challenges is crucial in pediatric perioperative management.

Reading therapy, especially picture books with narrative-rich and immersive educational and exemplar stories, has shown promising results in addressing emotional issues (Chengshi Deng et al., 2021). This aligns with social learning theory (Bandura et al., 1961), which posits that children learn through observation, imitation, and modeling. By reading picture books, children can find comfort and learn to cope

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https://doi.org/10.1016/j.pedn.2025.12.024
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with difficult situations by observing similar characters in the stories (Tielsch Goddard, 2011). The earliest perioperative picture book illustrating the T&A process was developed in Germany (Felder-Puig et al., 2003). It was confirmed to alleviate preoperative anxiety among children undergoing this surgery. In Sweden, a study team created a picture book specifically for pediatric ear, nose, and throat day surgery (Nilsson et al., 2016). The qualitative results showed that it could help children and their parents feel secure during day surgery. In China, a study developed an inpatient reading book titled "Little Rabbit's Diary of Emotions," detailing the rabbit's journey from outpatient consultation to hospitalization and finally to surgery (Hanping Guo et al., 2008). The results demonstrated that the book was well accepted by inpatient children and increased their understanding of the surgical process. Another study created a picture book for pediatric patients with congenital heart disease (Wang, 2020). Similarly, the entire process, from hospitalization and surgery to discharge, was depicted in this book. The results indicated significant improvements in postoperative anxiety for pediatric patients.

However, no evidence has been found to examine the effectiveness of reading therapy in improving pediatric patients' resilience and preventing behavioral problems when they were undergoing medical crisis, such as surgeries. As a core component of psychological health, resilience refers to a dynamic process encompassing positive adaptations to critical adversity (Luthar et al., 2000), essentially manifesting as the ability to maintain a pattern of positive responses and development in the face of crisis (Compas, 2006). A review confirmed that lack of resilience in children with medical traumatic stress might lead to poor adjustment, slow recovery, disruptive behaviors, and psychiatric disorders (Isokääntä et al., 2019). A meta-analysis also showed that resilience was strongly associated with better mental health outcomes, including reduced depression and anxiety (Hu et al., 2015). Research during the COVID-19 pandemic, particularly among HCPs and university students, has shown that resilience can mitigate the negative psychological impacts of stress, anxiety, and depression (Li et al., 2023).

*Picture books have the potential to enhance children's resilience* because of their unique strengths, which align well with the five factors associated with promoting resilience: (1) positive emotions (including optimism and humor), (2) cognitive flexibility (including positive explanatory style, positive appraisal, and acceptance), (3) meaning (including religion, spirituality, and altruism), (4) social support (including role models), and (5) an active coping style (including exercise and training)(Southwick et al., 2005). By purposively designing, picture books could establish a model character with positive emotions, flexible cogitation, strategic coping skills, accessible medical and social support, and the vividly depicted story would deliver a meaning of experiencing such a surgery.

Therefore, the aim of this study was three-fold: 1) to develop a T&A picture book based on the five factors of promoting resilience, 2) to evaluate the impact of reading this picture book on preventing psycho-behavioral problems as well as enhancing children's resilience, 3) to explore the acceptability of the picture book among T&A pediatric patients.

## Materials and methods

### *Study design*

The study adopted a mixed-method design with two stages. In the first stage, qualitative methods—including interviews, field observations, and expert consultation—were employed to develop the T&A educational picture book. In the second stage, a non-randomized controlled quantitative study was conducted from July 2022 to September 2022 at Xiangya Third Hospital, one of the largest comprehensive hospitals in Hunan, China, to evaluate the picture book's effectiveness in preventing children's perioperative psycho-behavioral problems. The study was reported in a manner consistent with child-centered principles for pediatric research (Foster et al., 2025).

### *Procedure*

Stage 1: Developing the T&A educational picture book

To capture the surgical scenarios and participants' natural behaviors during the surgery, field observations were conducted with children, parents, and HCPs two days before surgery, in the waiting room, before anesthesia, and three days post-surgery, until data saturation was achieved. Key observations included children's anxiety, children's behaviors in the waiting room, responses to anesthesia, and pain-coping methods. These provided a comprehensive understanding of children's emotions and behaviors during this period. The study also observed HCPs interactions to incorporate effective communication strategies into the book. This included how nurses comforted children, explained the surgery and procedures, and supported them during injections and post-surgery pain management. Surgeons' explanations of the surgical environment and anesthesia equipment were also noted. Lastly, parent-child interactions were observed to understand how parents explain surgery, comfort their children, and encourage recovery. This included pre-surgery explanations, comforting children post-surgery, and supporting their return to normal life.

Additionally, informal interviews were conducted with children. Each session lasted five to ten minutes, scheduled during breaks in care or treatment. To reduce the anxiety and discomfort of children, notes were taken instead of recordings to ensure confidentiality. The interviews aimed to explore children's fears, understanding, and imagination of the surgical process, providing insights for creating a relatable picture book. Topics included reasons for surgery, preoperative tests, perceptions of surgery, curiosity about surgical knowledge, fears and coping strategies, postoperative precautions, and additional questions they had about surgery.

*Thematic analysis (Braun & Clarke, 2006) and typical case analysis* were used to analyze observational and interview notes. Thematic analysis followed six stages—data familiarization, coding, theme development, review, definition, and reporting—to explore children's understanding of surgery and inform the picture book's content and design. Typical case analysis recorded children's behaviors, expressions, and coping strategies, integrating these with HCPs' comforting techniques into warm, engaging storylines. The information gathered guided the development of the content of the picture book. Detailed examples were shown in Appendix 1.

After 19 rounds of discussions and revisions, the storyline was developed by the study team, which covered four chapters: Preoperative Preparation, Surgical Adventure, Postoperative Recovery, and Return to the Forest, simulating the entire process of tonsillectomy surgery. Detailed examples were shown in Table 1. The picture book told a story of Brother Rabbit, who needed surgery to remove his enlarged adenoids and tonsils. He experienced a series of adventures in the operating room and eventually recovered and was discharged from the hospital. Other characters, such as "Sister Rabbit," "Mother Rabbit," "wise Nurse Nightingale," and knowledgeable "Doctor Woodpecker," were depicted to provide medical and psychological support.

We purposively integrated some elements to enhance children's resilience according to the five factors proposed by Southwick et al. (2005). (1) Cultivate positive emotion: The whole story illustrated a brave and optimistic protagonist who maintained the confidence to experience these challenges during the surgery process and finally rehabilitated well. For example, he claimed that he was "a brave warrior who dared to venture into the small dark room." (2) Establish cognitive flexibility: Several metaphors were used to reshape children's

Table 1
Chapter contents.

| Chapter title | Chapter contents |
|---|---|
| Preoperative Preparation | Due to long-term mouth breathing and frequent colds, Brother Rabbit is required to undergo surgery to remove the tonsils and adenoids. However, Brother Rabbit is very fearful of the unfamiliar term "surgery." Following that, Brother Rabbit vividly imagines the surgery, envisioning a "super scalpel" and "terrifying needles," along with an "evil anesthetist" who would knock him out with a stick. With the encouragement of Nurse Nightingale, Brother Rabbit bravely completes preoperative examinations and cooperates with the anesthesiologist in preparing for fasting, abstinence from drinking, and being mindful of loose teeth. |
| Surgical Adventure | Brother Rabbit enters the operating room, finding it devoid of the scary needles and syringes he has been imagining but rather filled with cheerful nurses. Next, Brother Rabbit encounters Little Pig in the waiting room. Little Pig already has an indwelling needle inserted and is ready to enter the operating room. Little Pig shares his experience of having the indwelling needle inserted with Brother Rabbit and encourages him to alleviate his fear of injections. Brother Rabbit bravely accepts the "indwelling needle challenge" and then enters the operating room. Inside, he encounters various magical instruments that guide him through a smooth surgery until he reaches the recovery room. While uncomfortable with the endotracheal tube, the warmth from the anesthesia nurse's hand gives him strength. After evaluation by the anesthesia nurse and anesthesiologist, Brother Rabbit meets the standards for muscle strength, consciousness, and blood oxygen saturation. The surgery is very successful, and Brother Rabbit reunites with his mother. |
| Postoperative Recovery | After entering the ward, Brother Rabbit sees other children who have undergone surgery, each at a different stage of recovery. They support each other, share joy and happiness, jointly endure pain, and share the recovery process. Brother Rabbit also receives support from school, such as visits from the music teacher, helping him overcome the fear of pain and encouraging him to speak. |
| Returning to the Forest | After recovering, Brother Rabbit returns home and conscientiously follows the care instructions provided by HCPs, such as avoiding sneezing and consuming soft food. Two weeks after surgery, Brother Rabbit finally resumes normal eating habits, and what awaits him is a healthier and more exciting school life. In the end, Brother Rabbit recalls his imaginary "Small Dark Room" in the operating room and realizes that it's not a "Small Dark Room" but a place filled with love. |

cognition about the operation and relevant medical procedures. For example, the book vividly described the oxygen mask as a hero's mask, and the electrodes of the electrocardiogram monitoring as amulets; thus, children would feel brave and be protected. (3) Provide useful coping techniques: Many techniques to cope with uncertainty, fear, or unease, for example, eating ice cream to reduce the pain of the throat after the T&A, were welcomed by all the children. (4) Provide social support sources: This book illustrated the kinds of social support children could access, such as peers' support, doctors' and nurses' professional support, and family members' care. Children who read the book would feel that they were not alone to face surgery. (5) Endow with meaning: We were trying to let children know that experiencing surgery was more than an adventure, but a personal growth both physically and psychologically. Thus, this book had a subtitle of "A different growth." At the end of the story, the protagonist expected to return to school energetically and told his story confidently. Therefore, we deliberately integrated the transmission of knowledge and resilience skills into the storyline. More details could be found in Appendix 2.

Three rounds of multidisciplinary expert consultations were conducted with one otolaryngology nursing expert, one operating room nursing expert, and one pediatric nursing expert to confirm the appropriateness and accuracy of the script. In addition, one children's literature writer and three school-aged children reviewed the draft to ensure that the story was child-friendly, emotionally appropriate, and easily comprehensible. Throughout the entire development process, one graduate student specializing in pediatric nursing, under the guidance of the pediatric nursing expert, coordinated revisions and incorporated feedback from all consultants. Finally, during the pilot testing phase, the graduate student read the story aloud to three school-aged children individually and observed their facial expressions, gestures, and emotional reactions—such as laughter at humorous moments or signs of confusion. Afterward, each child was asked to retell the story to confirm the clarity and appropriateness of narratives. Revisions were made based on these observations and expert feedback until consensus was reached among experts.

Finally, our team illustrated this story. The illustration used a child-friendly and warm artistic style, aiming to realistically simulate the surgical and ward environments, such as bedside cards in the ward, electrocardiogram monitoring in the operating room, and oxygen masks. The multidisciplinary team, including 3 school-aged children, was invited to read the picture book and provide feedback. Revisions were then made to finalize the picture book. Fig. 1 showed the illustration details. (See Fig. 2.)

Stage 2: Evaluating the impact of the book on children' resilience and behaviors

*Participants*

The participants in this study were children: (a) aged between 6 and 12 years; (b) who were scheduled to undergo T&An under general anesthesia according to Electronic Medical Record System; (c) who could read or listen to stories; and (d) who were native Chinese speakers able to communicate in Mandarin. However, individuals with mental retardation, attention deficit hyperactivity disorder (ADHD), or autism were excluded from the study. The study participants were recruited through posters displayed on the doors of the hospital wards. Sample size calculation was performed using the G*Power 3.1 program. The effect of resilience (primary outcome) was determined based on previous research conducted on children who underwent heart surgery using a 6-session resilience improvement program (Lee et al., 2017). The study revealed an effect size of 0.247, with 95 % power and 5 % significance level, utilizing two groups and four measurement points, and requiring a minimum of 30 samples. Ultimately, we recruited 68 children to participate in the experiment, who were divided into two arms (1:1) by time. The patients enrolled in July–August were assigned to the control group, while those enrolled in August–September were assigned to the intervention group.

*Intervention*

In our setting, children scheduled for T&A surgery are typically admitted two days before the operation for preoperative evaluation, health education, and psychological preparation by HCPs. Two days before the surgery, the children in the intervention group received an educational picture book titled "Different Growth – The Adventure in a Small Dark Room" developed by our team. The research assistant read the book to the children, explaining the images and text to them when their parents were present. Subsequently, a discussion about the story was conducted with the children to ensure that they paid attention to the images and texts as well as their understanding. The discussion method involved the researcher and the child reading through the manuscript together. During the reading, the researcher explained the illustrations and text, followed by a discussion of the storyline with the child to ensure comprehension. Children's verbal and non-verbal responses were treated as meaningful, and researchers responded to questions and sought clarification as needed to ensure understanding. The entire process took approximately 20 min. In the end, the picture book was given to the children, who could freely read it at any time during the perioperative period.

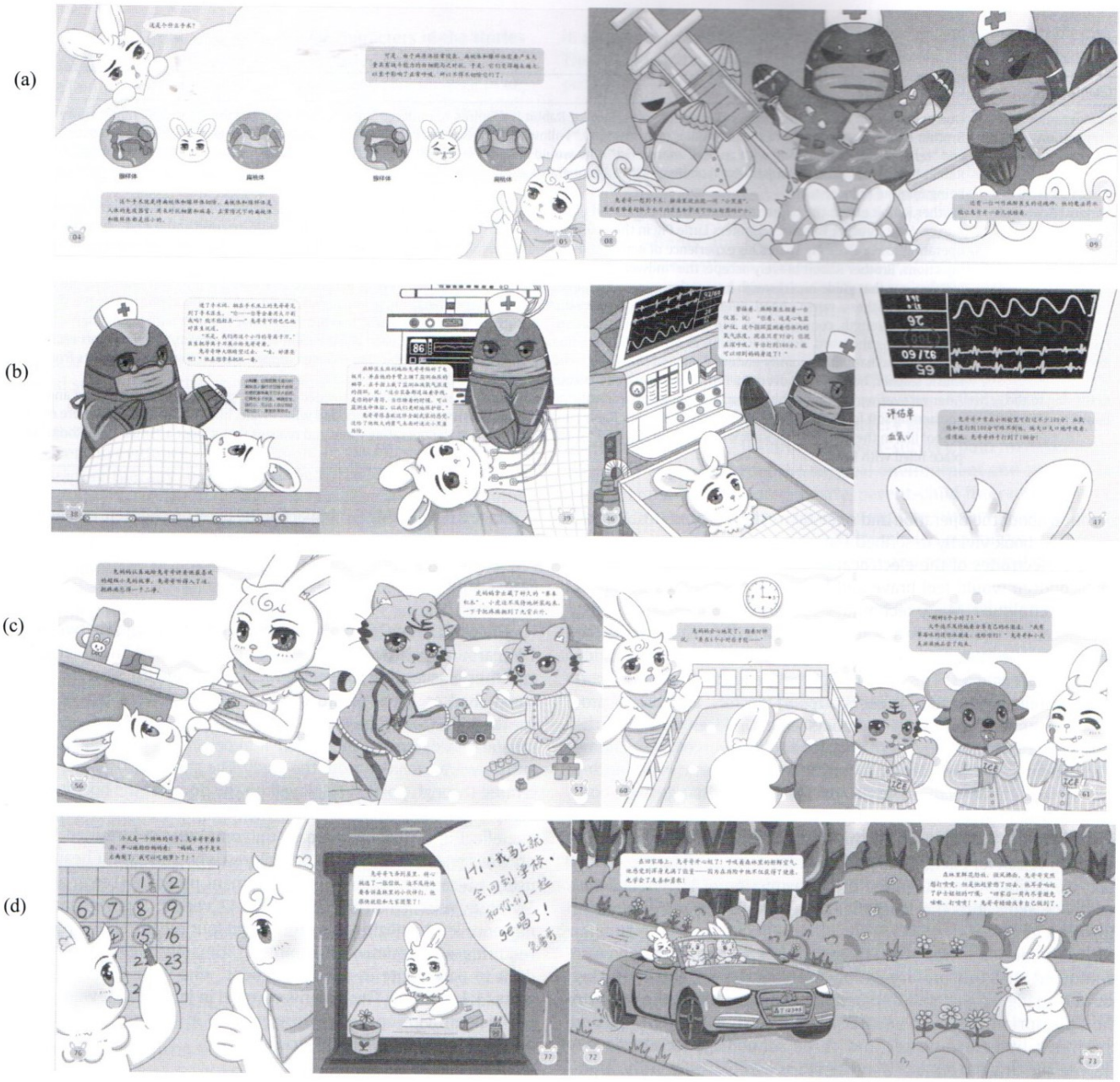


**Fig. 1.** Illustrations of this book. (a) Illustrations in Chapter 1. (b) Illustrations in Chapter 2. (c) Illustrations in Chapter 3. (d) Illustrations in Chapter 4.

The control group received standard care and conventional verbal education from nurses which covered the reasons for T&A, the necessity and process of preoperative examinations, an introduction to the anesthesia process, postoperative dietary care, and oral hygiene. At the end of the study, children in the control group could receive the T&A picture book designed by our team.

### *Variables and instruments*

#### *Demographic characteristics*

We recorded demographic information about the children, including age, gender, place of residence, whether they had siblings, surgical history, school attendance, and the degree of tonsillar hypertrophy. Parental variables included age, marital status, educational level, occupation, monthly family income, and healthcare payment method.

#### *Resilience*

The Chronic Illness Children's Resilience Scale (CICRS), compiled by Kim and Yoo (2010) was utilized in this study. This scale was translated into Chinese by Yang et al. (2012), which comprises 32 items divided into three dimensions: personality traits, coping strategies, and interpersonal relationships. Participants used a 4-point Likert scale to indicate their responses. The total score ranges from 32 to 128, with a higher score indicating greater resilience in children. The Cronbach's α coefficient for this scale is 0.92.

#### *Observer-rated preoperative anxiety*

The Modified Yale Preoperative Anxiety Scale (m-YPAS), developed by Kain et al. (1997) from Yale University, was used. It comprises four sections with a total of 22 items: activity (4 items), vocalizations (6 items), emotional expression (4 items), and observable alertness

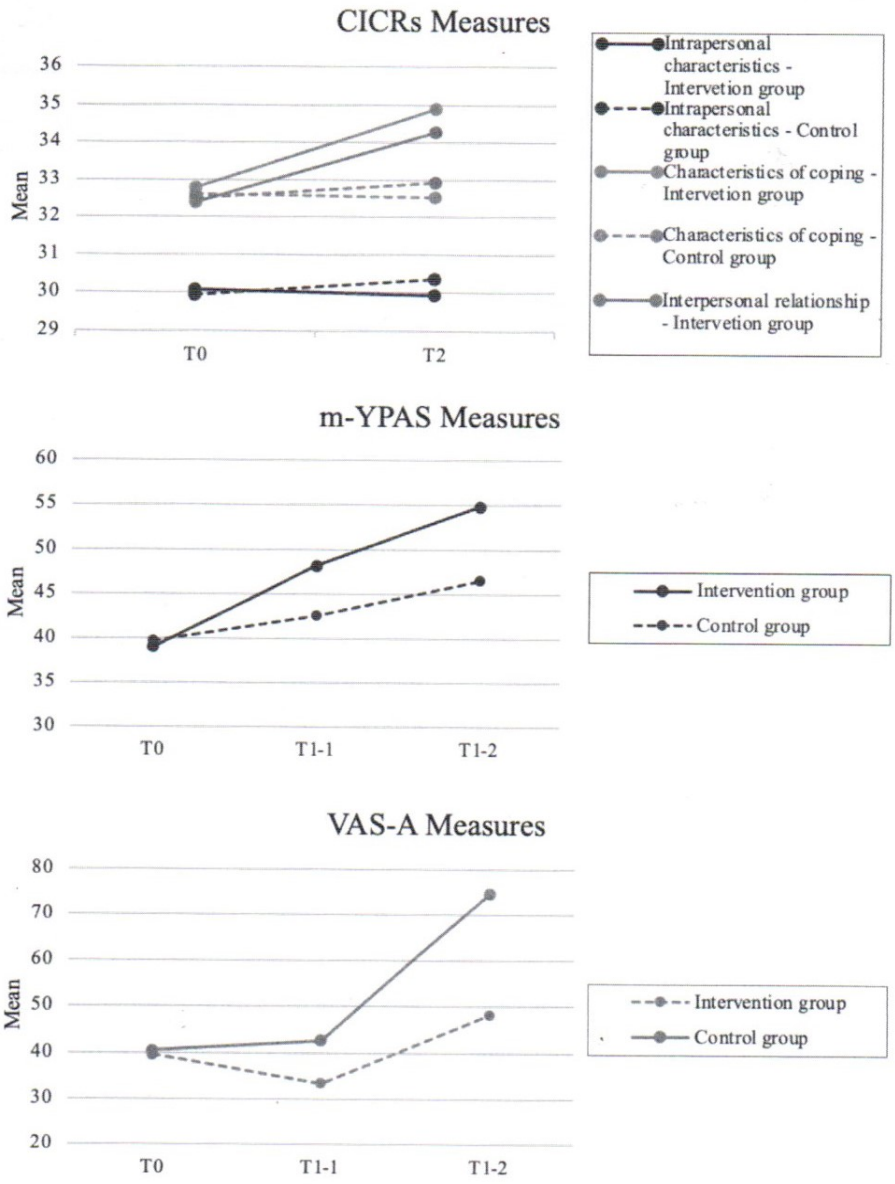



**Fig. 2.** CICRS, m-YPAS, and VAS-A measures over time.

(4 items). This scale relies on behavior observation for assessment and is an observer-rated instrument. The typical scoring duration is 1 min. The scale demonstrated reliability, with scores ranging from 0.68 to 0.86, internal consistency reliability from 0.63 to 0.90, and criterion-related validity of 0.7.

*Self-rated preoperative anxiety*

Kindler et al. (2000) demonstrated that the Visual Analog Scale (VAS) was a highly practical and effective tool for assessing the anxiety levels of surgical patients. The VAS is a 100 mm long line, with a total score ranging from 0 to 100. The scale is a self-assessment, and the assessment time is generally less than 1 min, with a criterion-related validity of 0.69 (Hao et al., 2016).

*Anesthetic compliance*

As an observer-rated instrument, Induction Compliance Checklist (ICC) scale was used to quantify the child's level of cooperation during the anesthesia induction phase (Kain et al., 1998). The scale consists of 11 items, where the absence of any negative behavior during the induction process is scored as 0 points. Each occurrence of negative behavior is scored as 1 point on the scale, with a maximum score of 11 points. Higher scores reflect poorer cooperation from the child. The scale's reliability (Cronbach's α) was 0.844, and the content validity (CVI) was 0.932.

*Pediatric anesthesia emergence delirium*

The Pediatric Anesthesia Emergence Delirium Scale (PAED) was used to assess the occurrence of emergence delirium in each child during general anesthesia recovery (Ringblom et al., 2018). The scale included five items related to the child's consciousness, behavior, and communication. Each item is scored on a 5-point Likert scale. The total score ranges from 0 to 20, with a higher score indicating more pronounced delirium. The Cronbach's α coefficient for this scale was 0.96.

*Post-hospitalization behavioral changes*

The Post-Hospitalization Behavior Questionnaire (PHBQ) is a widely used scale for assessing postoperative behavioral changes in children

(Vernon et al., 1966). The scale includes six dimensions: overall anxiety, separation anxiety, sleep anxiety, eating disorders, aggression, and withdrawal, with a total of 27 items. Parents compare their child's pre- and post-operative states for each item. The scoring system is 0 for no change, −1 for some relief, −2 for significant relief, +1 for some increase, and + 2 for a significant increase compared to preoperative status. The scores for each item are summed to obtain the total score, and a total score greater than 0 indicates negative postoperative behavioral changes. The Cronbach's α coefficient for this scale was 0.93. For analyses (Han et al., 2021), the postoperative sleep change score was converted into rate, which was calculated as the number of cases with behavior changes after surgery divided by the total number of cases, multiplied by 100 %.

*Acceptability*

We define acceptability as the degree to which children like the picture book. Children and parents in the intervention group were briefly interviewed about their general impression of the picture book using a Likert scale, with responses ranging from 0 (very bad) to 10 (very good). These responses were based on the number of times they read the book, how long it took to finish one reading, whether they communicated with their parents after reading, and their willingness to introduce the book to others.

*Data collection*

Data were collected at different time points (Table 2), which were at the 2-day preoperative visit (T0), entry of the waiting room (T1–1), anesthesia induction (T1–2), start of the surgery (T1–3), anesthesia recovery (T1–3), 3-day postoperative follow-up (T2–1), and 1-month postoperative follow-up (T2–2) (Table 2).

As detailed in Table 2, the selection of evaluation methods was guided by children's developmental stage and cognitive capacity. During perioperative periods, observer-rated measures—including m-YPAS, ICC, and PAED—were primarily used to reduce the burden of child self-report. Parent-reported outcomes were assessed using the PHBQ. Child self-assessment measures were limited to developmentally appropriate instruments, including VAS-A, CICRS, and brief questionnaires evaluating children's acceptance of the picture book intervention. Parents were allowed to be present with their child during data collection when permitted by routine clinical practice (T0, T1–1, T2–1, T2–2).

Observer-rated assessments were independently completed by two HCPs working in the ward or operating room, both of whom were blinded to group allocation. Child self-assessments and parent-reported questionnaires were collected face-to-face at all applicable time points, except for the 1-month postoperative follow-up (T2–2), when data were collected via telephone interviews, as all children had been discharged.

*Ethical considerations*

The development and evaluation of the picture book were approved by the Institutional Review Board of the Xiangya Nursing School (E2021129; E2021127). Parents were approached during the preoperative visit, prior two days of surgery, when they were not under acute procedural time pressure. Written and verbal information regarding the study purpose, procedures, potential benefits, and minimal risks was provided, and parents were given adequate time to consider participation and ask questions before providing written informed consent. In addition to parental consent, children received an age-appropriate explanation of the study using simple language and visual cues. Children were explicitly asked whether they were willing to participate, and their verbal or behavioral assent was respected. If a child appeared distressed or negatively affected at any point during the study, parents were informed, and supportive actions were taken as needed. As compensation for their time, all participants received a stationery package valued at 25 RMB (~$3.5) immediately after completing the baseline questionnaire. The control group children received a free copy of the same picture book used in the intervention group at the end of the study.

*Data analysis*

The paper-based data were entered into SPSS 20.0 software and double-checked by another research assistant. Categorical variables were described using frequencies and percentages, and means and standard deviations were used to describe the distributions of continuous variables if they were normally distributed. Statistical significance was set at a two- sided with $\alpha < 0.05$. The analysis was based on intention-to-treat with per-protocol analysis (Friedman et al., 2015). Independent group comparisons of the categorical variables were

**Table 2**
Schedule for questionnaire administration.

| | Before surgery/Baseline (T0) | During surgery(T1) | | After surgery(T2) | | Evaluation methods | | | |
|---|---|---|---|---|---|---|---|---|---|
| Questionnaire/scale | Preoperative 2 days (T0) | Enter the waiting room (T1–1) | Anesthesia induction (T1–2) | Anesthesia recovery (T1–3) | Postoperative 3 days (T2–1) | Postoperative 1 month (T2–2) | Observer-assessment | Self-assessment | Parent-reported |
| Modified Yale Preoperative Anxiety Scale, m-YPAS | ✓ | ✓ | ✓ | | | | ✓ | | |
| Visual analog scale for anxiety, VAS-A | ✓ | ✓ | ✓ | | | | | ✓ (children) | |
| Induction Compliance Checklist, ICC | | | ✓ | | | | ✓ | | |
| Pediatric Anesthesia Emergence Delirium Scale, PAED | | | | ✓ | | | ✓ | | |
| Chronic Illness Children's Resilience Scale, CICRS | ✓ | | | | | ✓ | | ✓ (children) | |
| Post Hospitalization Behavior Questionnaire, PHBQ | | | | | ✓ | ✓ | | | ✓ (parents) |
| Acceptability | | | | | | ✓ | | ✓ (children) | |

analyzed using the chi-square test. In the comparison of the mean of two independent groups with a normal distribution, the *t*-test was used, and the Mann–Whitney *U* test was used for those without normal distribution. The repeated measures analysis of variance (ANOVA) test was used for repeated measurements for normally distributed data, and the Friedman test was used for non-normally distributed data.

## Results

### Characteristics of the participants

Among the 68 pediatric participants, 32 were boys and 36 were girls, with an average age of 7.6 ± 1.64 years. About 73.53 % of the children resided in urban areas, and 48.53 % were the "only child" in their families. The majority (92.55 %) were currently attending primary school, and 83.82 % had no prior surgical experience. Regarding the degree of tonsillar hypertrophy, 36.76 % were classified as Grade II, and 73.53 % were Grade III.

Among the parents of the 68 children, there were 13 fathers and 55 mothers, with an average age of 43.5 ± 4.13 years. The predominant education level was associate degree (41 %), and 41.7 % of families had a monthly income ranging from 461 to 769 USD. Most families (86.7 %) used self-payment for hospitalization expenses. There were no statistically significant differences in general information between the two groups of children and parents ($p > 0.05$) (Table 3).

### Resilience

The scores on the CICRS in both groups were not significantly different at baseline, and both increased over time. Among the three dimensions of the resilience scale, the repeated measures ANOVA results showed a statistically significant time × group interaction between coping characteristics and interpersonal characteristics ($F_{\text{characteristics of coping}} = 12.61$, $p < 0.05$; $F_{\text{interpersonal relationship}} = 9.27$, $p < 0.001$). Only coping dimension characteristics differed significantly across the groups ($F_{\text{characteristics of coping}} = 18.42$, $p < 0.001$) (Table 4).

**Table 3**
Characteristics of the children and their parents in the two groups ($N = 68$).

| Variable | Intervention group ($n = 34$) | Control group (n = 34) | F/χ2 | *p* |
|---|---|---|---|---|
| | Mean (SD)/n (%) | Mean (SD)/n (%) | | |
| Children's characteristics | | | | |
| Gender | | | | |
| Male | 17 (56.70) | 14 (46.70) | 0.601 | 0.438 |
| Female | 13 (43.30) | 16 (53.30) | | |
| Residence | | | | |
| City | 9 (30.00) | 11 (36.70) | 0.300 | 0.584 |
| Countryside | 21 (70.00) | 19 (63.30) | | |
| Having siblings | | | | |
| Yes | 21 (70.00) | 23 (76.7) | 0.341 | 0.559 |
| No | 9 (30.00) | 7 (23.3) | | |
| Surgical history | | | | |
| Yes | 6 (17.65) | 5 (14.71) | | |
| No | 28 (82.35) | 29 (85.29) | 0.108 | 0.742 |
| School attendance | | | | |
| Yes | 32 (94.12) | 31 (91.18) | | |
| No | 2 (5.88) | 3 (8.82) | 0.216 | 0.642 |
| Degree of tonsillar hypertrophy | | | | |
| Grade II | 16 (47.06) | 9 (26.47) | | |
| Grade III | 18 (52.94) | 25 (73.53) | 3.100 | 0.078 |
| Caregiver | | | | |
| Father | 6 (17.65) | 7 (10.29) | | |
| Mother | 28 (82.35) | 27 (79.41) | 2.161 | 0.826 |
| Parents' characteristics | | | | |
| Age | 43.794 ± 4.021 | 43.324 ± 4.347 | 0.463 | 0.645 |
| Education level | | | | |
| Primary School | 1 (2.94) | 2 (5.88) | | |
| Middle School and High School | 8 (23.53) | 5 (14.71) | | |
| Associate Degree | 15 (44.12) | 13 (38.24) | | |
| Bachelor's Degree | 5 (14.71) | 8 (23.53) | | |
| Graduate Degree and above | 5 (14.71) | 6 (17.65) | 1.952 | 0.745 |
| Occupation | | | | |
| Corporate employees | 4 (11.76) | 6 (17.65) | | |
| Public institution employees | 5 (14.71) | 10 (29.41) | | |
| Migrant workers/farmers | 5 (14.71) | 4 (11.76) | | |
| Individual business owner | 6 (17.65) | 6 (17.65) | | |
| Freelancer | 7 (20.59) | 5 (14.71) | | |
| Other | 7 (20.59) | 3 (8.82) | 4.111 | 0.534 |
| Monthly family income | | | | |
| ≤999 RMB (Less than or equal to 154 USD) | 1 (2.94) | 2 (5.88) | | |
| 1000-2999RMB (154–461 USD) | 8 (23.53) | 5 (14.71) | | |
| 3000-4999RMB (461–769 USD) | 15 (44.12) | 13 (38.24) | | |
| 5000-9999RMB (769–1538 USD) | 5 (14.71) | 8 (23.53) | | |
| ≥10000RMB (≥1538 USD) | 5 (14.71) | 6 (17.65) | 1.952 | 0.745 |
| Healthcare payment method | | | | |
| Out-of-pocket | 30 (88.24) | 29 (85.29) | | |
| Health insurance | 4 (11.76) | 5 (14.71) | 0.128 | 0.720 |

**Table 4**
Means, standard deviations, repeated measure ANOVA analysis, and t-test of outcome variables (N = 68).

| Measures | Dimension | Groups | Before surgery/ Baseline (T0) | During surgery (T1) | | | After surgery(T2) | | ANOVA | | t |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Preoperative 2 days (T0) | Enter the waiting room (T1–1) | Anesthesia induction (T1–2) | Anesthesia recovery (T1–3) | Postoperative 3 days (T2–1) | Postoperative 1 month (T2–2) | Group | Group × Time | |
| | | | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | F | F | |
| CICRS | Intrapersonal characteristics | Intervention group | 30.09 ± 1.24 | | | | | 30.56 ± 1.28 | 0.011 | 0.916 | |
| | | Control group | 29.94 ± 1.52 | | | | | 30.35 ± 1.54 | | | |
| | Characteristics of coping | Intervention group | 32.79 ± 1.75 | | | | | 34.88 ± 1.90 | 18.42** | 12.61* | |
| | | Control group | 32.62 ± 1.58 | | | | | 32.53 ± 1.76 | | | |
| | Interpersonal relationship | Intervention group | 32.38 ± 1.88 | | | | | 34.26 ± 1.96 | 2.807 | 9.27** | |
| | | Control group | 32.50 ± 1.69 | | | | | 32.91 ± 1.73 | | | |
| m-YPAS | | Intervention group | 39.03 ± 4.73 | 48.16 ± 5.25 | 54.77 ± 6.43 | | | | 35.96** | 11.71** | |
| | | Control group | 39.76 ± 4.95 | 42.64 ± 3.37 | 46.56 ± 3.80 | | | | | | |
| VAS-A | | Intervention group | 39.52 ± 14.90 | 33.38 ± 17.42 | 48.14 ± 16.64 | | | | 16.768** | 16.074** | |
| | | Control group | 40.44 ± 22.29 | 42.64 ± 23.37 | 74.55 ± 20.26 | | | | | | |
| ICC | | Intervention group | | | 0.29 ± 0.52 | | | | | | 2.36* |
| | | Control group | | | 0.62 ± 0.60 | | | | | | |
| PAED | | Intervention group | | | | 7.68 ± 5.32 | | | | | 2.471* |
| | | Control group | | | | 10.94 ± 5.58 | | | | | |

*Observer-rated preoperative anxiety*

The scores on the m-YPAS in the two groups were not significantly different at baseline and both increased over time. The score of the intervention group was lower than that of the control group at each time point, and the impact lasted until T1–2 (anesthesia induction). Repeated measures of ANOVA showed statistically significant differences between groups ($F = 35.96$, $p < 0.001$) and across time points ($F = 144.85$, $p < 0.001$). A statistically significant interaction was found between time and group ($F = 11.71$, $p < 0.001$) (Table 4).

*Self-rated preoperative anxiety*

The VAS scores were equal in the two groups at baseline and both increased over time. The score of the intervention group was lower than that of the control group at each time point, and the impact lasted until T1–2 (anesthesia induction). Repeated measures ANOVA showed statistically significant differences between groups ($F = 16.768$, $p < 0.001$) and across time points ($F = 248.158$, $p < 0.001$). A statistically significant interaction was found between time and group ($F = 16.074$, $p < 0.001$) (Table 4).

*Anesthesia compliance*

Analysis of compliance during anesthesia induction revealed that the intervention group had significantly lower score compared to the control group ($t = 2.36$, $p = 0.021$), showing better anesthesia compliance. (Table 4).

*Pediatric anesthesia emergence delirium*

The intervention group had significantly lower scores than the control group ($t = 2.471$, $p = 0.016$), showing less delirium during the anesthesia recovery period, compared to the control group. (Table 4).

*Post-hospitalization behavior change rate*

The results of postoperative adverse behavior scores showed that, on postoperative day 3, the incidence of adverse behaviors in the intervention group (5.88 %) was significantly lower than that in the control group (19.12 %) ($\chi^2 = 5.445$, $p < 0.05$). However, at the 1-month postoperative follow-up, there was no significant difference in the incidence of adverse behaviors between the intervention (2.94 %) and control groups (8.82 %) ($\chi^2 = 0.266$, $p = 0.606$).

*Acceptability*

The picture book showed high acceptability, with an average liking score of 9.56 out of 10 which represented highly acceptable.Also, among the 34 participants, 55.9 % rated the score of 10 and 44.1 % gave the score of 9. All children kept the picture book, with 88.2 % of them reading it 3–5 times. Most children (85.2 %) spent 10–20 min reading the book each time, and 100 % of the children reported sharing the book with their families after reading.

## Discussion

Our study rigorously developed a picture book based on observations, interviews, and five factors related to resilience to address the psycho-behavioral challenges faced by children undergoing T &A surgery. The results indicated that reading our picture book could enhance children's resilience, alleviate perioperative anxiety, improve anesthesia compliance, reduce postanesthetic agitation, and decrease adverse behavior changes in the first three days postoperatively. This study provided an easy, acceptable, and effective educational approach for pediatric HCPs to prevent psycho-behavioral problems among children undergoing surgery.

Similar to previous studies on picture books for children undergoing surgery, this book described the entire process from preoperative examination, anesthesia induction, and postoperative hospitalization

rehabilitation after discharge. However, distinct from scenario cards (Nilsson et al., 2016), surgical flip charts (Ono et al., 2007), and leaflets (Kassai et al., 2016), we introduced a role model character based on five factors related to resilience; Brother Rabbit, who undergoes the same surgical process as the children but consistently demonstrates a positive and brave attitude. In this study, the intervention group exhibited higher levels of resilience, primarily in the two subscales of interpersonal relationships and coping methods. According to (Bandura et al., 1961) social learning theory, children can learn implicitly from the resilient role model—Brother Rabbit. Strong role models serve an important educational and developmental function for resilient individuals (Southwick et al., 2005). At every stage of life, observation and imitation constitute powerful forms of learning that can alter the course of one's development (Southwick et al., 2005). The role model of Brother Rabbit facing surgery in this picture book can help children explore and understand different coping techniques and interpersonal relationships. For example, through the book, the children learn how to overcome fear and encourage their peers with words, sharing ice cream, etc., when facing postoperative pain, as the animal characters in the book do. This can help children develop interpersonal skills. However, we found no statistically significant differences in the dimensions of intrapersonal characteristics. This may be attributed to the relative stability of intrapersonal characteristics in pediatric patients over the course of one month (Shiner & Caspi, 2003). Similarly, resilience has been shown to be enhanced in children with Henoch–Schoenlein purpura nephritis through picture books (Tang et al., 2023).

Picture books have also been shown to reduce children's anxiety levels. Previous research has indicated that characters and scenarios in picture books could allow children to experience surgical scenes in a virtual setting (Sadeghi et al., 2017). This helped them to understand and cope with complex emotional issues, effectively promoting children's mental health and adaptability (Sadeghi et al., 2017). The picture book provides a comprehensive depiction of the preoperative, intraoperative, and postoperative processes, along with coping strategies, for example, when facing preoperative examinations. Brother Rabbit views preoperative examinations as a health test adventure, needing to pass each checkpoint to qualify for the "Small Dark Room" adventure. The illustrations help children imagine the events and scenes in the story, allowing them to understand surgery as if they were there, thereby alleviating their anxiety when they eventually face surgery. As one little boy in the intervention group said, "The surgery became an exam where the answers were already known."

The picture book also enhanced children's anesthesia compliance and reduced postanesthetic agitation. Preoperative education can significantly reduce postoperative agitation and anesthesia compliance in children (Jin et al., 2021). In the book, we provided a detailed description of the anesthesia process and the experience in the anesthesia recovery room, along with positive emotional cues, such as: "Brother Rabbit enjoys the feeling of being fully equipped (wearing a hero's mask on his face, and a protective charm on his chest), which gives him a great sense of security as he prepares for surgery." Our picture book also introduces many scenes of anesthesia recovery, helping children navigate this process (such as the need for deep breathing and maintaining blood oxygen saturation at 100 %, similar to achieving a perfect score on an academic exam, etc.). Children can subtly learn these coping techniques, thereby reducing postanesthetic agitation.

With respect to postoperative behavioral changes, this study demonstrated that the intervention group had a significantly lower rate of adverse behaviors in the first three days postoperatively. As indicated in prior research (Watson & Visram, 2003), anxiety serves as a predictive indicator for adverse postoperative behavior, with a correlation between a more relaxed preoperative mood and fewer postoperative behavioral issues. Therefore, it can be inferred that the lower anxiety levels during the surgical period in the intervention group may contribute to the reduced incidence of adverse behaviors in the postoperative phase (Sekhavatpour et al., 2019).This study also found that reading picture books could effectively reduce postoperative anxiety and behavioral disorders in children. Children typically recover by the third week after undergoing T&A (Lao et al., 2020); thus, data collected at the 1-month postoperative follow-up may not yield statistical significance.

Our picture book demonstrated a high level of acceptability. The children who participated in our study liked this picture book. Some children in the intervention group even expressed excitement when heading to the operating room and said, "I'm going on an adventure in the operating room!" The narratives of this picture book were closely related to the children's experiences and emotional journeys, fostering a sense of resonance and emotional engagement. By engaging visual descriptions and adventurous storylines related to surgery, the picture book can easily capture children's attention, making them willing to read it.

### *Strengths and limitations*

This study has several strengths. First, the intervention was developed through a rigorous, theory-informed qualitative process involving children, parents, healthcare providers, and experts, resulting in an engaging picture book with strong clinical relevance. Second, the use of multiple outcome measures across perioperative time points allowed for a comprehensive assessment of psycho-behavioral responses. This study also has some limitations that we acknowledge. Firstly, to avoid contamination of the intervention between the two groups, we divided the two groups by time rather than by randomization. Therefore, we adopted a non-randomized controlled research design. However, since the study setting was the same, there were fewer environmental and technical differences during the two study periods; thus, the reliability of the results could be assured. In addition, it is recommended that future research adopts a randomized controlled trial (RCT) study design. Secondly, our study did not measure the interrater reliability for the scales of m-YPAS, ICC, and PAED. However, the two HCPs were blind to the participants' group application and performed the recordings based on their standard training. Thirdly, we utilized two scales to assess anxiety levels: the observer-rated m-YPAS and the self-rated VAS. The results from these two scales corroborate each other, but social desirability bias may still exist. Future research could consider using objective measurements, such as salivary cortisol as a physiological indicator of stress. Fourthly, using CICRS in an acute perioperative phase may be a limitation, as the scale was originally developed for children with chronic illnesses. However, because most children undergoing T&A in our study had underlying conditions such as obstructive sleep disorders, applying CICRS remains conceptually appropriate for this population.

### *Implications to practice*

This study not only offers HCPs a simple, acceptable, and effective educational tool, but also provides an interesting and efficient approach for health education for children undergoing clinical challenges. This study also advocates paying attention to children's psychological and behavior changes when experiencing illnesses or medical procedures. More purposively designed and targeted educational picture books are needed in clinical settings.

## Conclusion

The educational picture book specifically developed for children undergoing T&A effectively alleviated their perioperative anxiety, enhanced resilience, improved anesthesia compliance, reduced postanesthetic agitation, and decreased post-hospitalization behavioral changes. Moreover, as an educational tool, the picture books are warmly accepted by the children.

## CRediT authorship contribution statement

**Yao Tang:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **Ka Yan Ho:** Writing – review & editing. **Jinlin Ye:** Writing – original draft. **Lei Yang:** Writing – original draft. **Yunfan Li:** Writing – original draft. **Xianhong Li:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization.

## Funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Declaration of competing interest

All authors declare no conflict of interest.

## Acknowledgments

We thank all the study participants. Additionally, we thank HCPs of the Xiangya Third Hospital for their support of this study. We thank Yuqian Deng and Yunxia Chen for drawing this picture book.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pedn.2025.12.024.

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