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Providing preoperative information for children undergoing surgery: a randomized study testing different types of educational material to reduce children's preoperative worries

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Abstract

This study developed three types of educational preoperative materials and examined their efficacy in preparing children for surgery by analysing children's preoperative worries and parental anxiety. The sample was recruited from three hospitals in Lisbon and consisted of 125 children, aged 8–12 years, scheduled to undergo outpatient surgery. The participants were randomly assigned to one of the seven independent conditions that were combined into the following three main groups: an experimental group, which received educational materials with information about surgery and hospitalization (a board game, a video or a booklet); a comparison group, which received entertaining material with the same format type; and a control group, which did not receive any material. Children's preoperative worries and parental anxiety were evaluated after the experimental manipulation. Children who received educational materials were significantly less worried about surgery and hospital procedures than children in the comparison and the control groups, although no statistically differences were found between the type of materials within the experimental group, and no significant effect occurred on parental state anxiety. These results do however support the hypothesis that providing preoperative materials with educational information reduce children's preoperative worries.

Introduction

Preoperative interventions have been increasingly used in the hospital settings for the last few decades [1, 2]. The negative impact of surgery on children and their families has been largely recognized in the literature [3–5]. Surgery tends to evoke negative behaviors and feelings in children, such as avoidance, guilt, sadness and distrust, which have been related to preoperative fears and anxiety [6, 7]. The period that precedes surgery involves an emotional and stress overload [8], with potential negative consequences during and after surgery [9], including phases such as the induction of anesthesia, the recovery period and the postoperative period [5, 10]. Several preoperative types of interventions (i.e. pharmacological, behavioral/psychological) have been used to reduce the negative responses of children and their family, to increase the cooperation and compliance during the medical process, to promote self-efficacy and sense of control, and to improve the postoperative recovery and the emotional adjustment after medical discharge [11–13].

Research has shown that interventional preparation programs that provide educational information positively tend to affect children, parents and

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healthcare professionals [14, 15]. The expected positive health outcomes may include a reduction in children's stress levels, an improvement of the child's cooperation with the healthcare professionals and a stronger adhesion to medical procedures [11, 12]. These outcomes may be related to an increase in the child's sense of self-control, decrease of unrealistic expectations and of inappropriate concerns with hospitalization and surgery [14], and greater trust and confidence on the healthcare professionals [11, 12]. These benefits may also reduce postoperative maladaptive emotional and behavioral responses, decrease pain perception and foster a faster recovery [14]. Research has also shown that providing educational information using books, medical play and peer modeling videos (i.e. observation of appropriate behaviors executed by a similar model) are the most appropriate and effective methods for children to learn effective strategies for coping with surgery, in particular during the concrete operational stage of development (children aged approximately between 7 and 12 years old), according to Piaget's theory (1963) [12, 16, 17]. Taking this into account, we developed three types of educational preoperative materials (i.e. a booklet, a board game and a video) to prepare children for outpatient surgeries, also designated as same-day surgeries.

Worry and anxiety are related constructs, although independent and therefore they should be conceptually distinguished [18]. Anxiety is a global construct that includes somatic, cognitive and behavioral components, whereas worry is conceptualized as a cognitive construct, and a major component of generalized anxiety disorder [18, 19]. Previous studies have focused on distracting the children from anxiety without addressing children's specific worries to preoperative scenarios and medical procedures (e.g. hospital rules about food and clothing, administration of premedication and anesthetic procedures). Moreover, to our knowledge, no study has compared the effects of both educational and entertainment preoperative materials on children responses, with the exception of two studies: one conducted about the effects of hospital clowns [20] and the other on the efficacy of an educational multimedia application [21]. These studies are relevant because they showed that when children interact with professional hospital clowns [20] or receive information using an interactive multimedia program that combine several techniques (e.g. videos, minigames) [21] they tend to report less preoperative worries about surgery.

This study aimed to provide clear information about the impact and efficacy of educational preoperative materials, by using a randomized controlled trial to examine their effects on children's preoperative worries and also on parental state anxiety before surgery. Children were randomly assigned to one of seven independent conditions that were combined into the following three main groups, based on the content of the materials they received: (i) children in the experimental group received educational materials about surgery and hospitalization in the format of a board game, a video or a booklet; (ii) children in the comparison group received material in the same three formats as the experimental group but the materials contained no information about surgery or hospitalization; and (iii) the control group did not receive any material. The use of three types of materials (board game, video or booklet) in the experimental group was important to analyse whether the format of the information might have different impacts on children's responses. In addition, the use of a comparison group in which children received the same-type of material was relevant to differentiate the content of the material and to ascertain whether the effects can be due to specific educational information about surgery or more related to the a mere entertainment activity which may distract children from their preoperative worries. A control condition was necessary to compare both previous groups with the standard hospital procedures.

Based on previous research that have shown the important effects of preoperative programs on the decrease of anxiety [14, 22] and preoperative worries [21], and especially those in which information about surgery was provided to children, we hypothesized that children in the experimental group would report less preoperative worries about surgery when compared with children in both the comparison and

the control groups. Due to the potential of distraction achieved by the entertainment materials, we also examined the differences between the comparison and the control groups, and expected that children in the comparison group would report less preoperative worries [1, 12]. Although the educational information provided was the same in all of the three materials (board game, video or booklet) within the experimental group, we expected the booklet to be the least effective in reducing preoperative worries because the board game is interactive and the video illustrates a behavioral model using real children.

Several other important factors may also affect children's worries; therefore, additional variables were collected, such as demographic, clinical information, temperamental dispositions, coping strategies and parental anxiety [15, 23, 24] to examine the degree of their relationship with the child's preoperative worries and to analyse whether these variables predict a significant amount of the variance in preoperative worries beyond what might be accounted by the intervention.

Previous research suggested that negative behaviors and preoperative anxiety are more common in older children [20, 25], females [25–27] and children with previous surgery experience [13, 28, 29]. We expected that these factors could predict children's preoperative worries, since they are vulnerability factors for the clinical symptoms of anxiety [19]. The evaluation of the children's temperamental disposition, defined as the way children typically respond emotionally and behaviorally to the environmental events [30, 31], is also important because some temperamental dimensions, such as shyness, emotionality, sociability and activity, tend to be associated with worries and distress [20, 21, 32–34]. In addition, the type of strategies that children use to cope with disease, hospitalization and surgery might be relevant to predict children's worries about surgery. Coping is defined as the set of strategies people use to adapt to stressful situations [35, 36] and adverse events [12, 37]. The efficacy of preoperative preparation programs could be affected by the individual coping strategies [38]. According to literature [38, 39], preoperative materials could be more effective for children who have a tendency to seek information, in contrast with children who have a tendency to avoid receiving specific information about their problems [40–42].

It is also common for parents to experience anxiety during the preoperative period, which might be transmitted to the child and negatively affect them [43]. Previous studies suggested that children whose parents are more anxious also have higher levels of anxiety and distress [5]. Therefore, the inclusion of this variable in our study is important to understand the effects of our intervention on children's worries. In addition, we analysed the effects of our intervention on parental state anxiety. Previous studies have shown a decrease on anxiety levels during preoperative preparation programs [21, 29], or while they watch their child being entertained during the preoperative period [21]. Thus, we expected that parents in the experimental and comparison groups would report less state anxiety compared with those in the control group. We also examined for potential differences between the experimental and comparison groups.

Finally, the preoperative period may have a negative impact on children's emotional states, resulting in feelings of fear, anger and sadness [12]. Due to the fact that the materials provided to the experimental and comparison groups were written in a playful and pleasant style, we asked children from these two groups to report the emotions they felt (i.e. happiness, fear, anger and sadness) to examine the potential emotional impact of the materials. We expected that children would report more positive emotions at the end of the materials' application.

Methods

Participants

The project was conducted at three different hospitals located in the Lisbon metropolitan area from November 2010 to May 2012. The committees of the hospitals which oversee research approved the project.

Sample size estimation

The sample size originally estimated for each one of the seven conditions was 30 participants, which

would yield a total of 210 participants. However, according to the suggestions provided by the healthcare professionals during our meetings at the hospitals, this sample size was unrealistic to be collect in a period of 1 year. Therefore, we took into account minimum sample size recommendations for conducting our main analyses [44]: at least 30 participants in each of the three main group conditions (i.e. experimental, comparison and control) and 15 participants within each subgroup (i.e. type of material: booklet, video and board game), yielding 45 participants for each of the interventional groups (experimental and comparison). In addition, we decided to increase the control group (for $n = 35$) to minimize the size discrepancies between the three main groups. Thus, a minimum of 125 participants should be recruited. G*Power 3.2.3 software analysis [45] was also used to estimate the sample size. Based on conventional recommendations for social and medical sciences [46, 47, 48] we set the statistical power at 0.80 (for Type II error), the alpha level at 0.05 (for Type I error) and have considered the type of statistical analyses we would be conducting to test our main hypotheses. Power analysis estimates for analyses of variance (ANOVAs) with three main groups indicated that for detecting a medium effect size ($f = 0.25$, using Cohen's standard effect sizes) the total size required would be 159 and 66 for a large effect size ($f = 0.40$) [49]. To maximize statistical power, we chose to conduct planned contrasts to test our main hypotheses. We also conducted principal components analysis (PCA) on the results of both the EAS and SCSI to examine their factor structure, since both instruments were developed to be used for self-report, and in our study we asked parents to evaluate their children. Several authors have proposed different minimum ratios of participants for the number of items. Cattel [50] suggested a minimum sample of 1:3 per item; Gorsuch [51] and Hair *et al.* [52] suggested a ratio of 1:5. Other researchers suggested a sampling of at least 100 [51–53] while others recommended being at least 50 participants [54]. Because the recruitment of participants in a clinical setting is very difficult, Bujang *et al.* [55] took into account several statistics (e.g. factor loadings, corrected item-total correlation, communalities, total variance explained, internal consistency) and the type of measurement scales, to estimate a sufficient sample size for a reliable PCA. They found that a sample size ratio of 1:5 would be sufficient to yield an appropriate and stable factor solution for any type of measurement scales. Thus, with a total of at least 125 participants, all minimum requirements will be ensured to proceed with our analyses. However, the period of collecting data was extended to a period of 18 months to guarantee this sample size.

The sample was initially composed of 127 children; however, two children were not included in the study due to sensory and mental disabilities. Exclusion criteria (i.e. children and parents who did not speak Portuguese; children with sensory or mental disabilities, such as developmental delay or blindness) were used to guarantee that all participants would understand the materials and the scale items to report their responses. The final sample was composed of 125 children of both genders (99 males, 26 females), aged between 8 and 12 years old ($M = 10.09$; $SD = 1.43$), who were scheduled for minor and outpatient surgery. The most common surgical procedures were circumcisions (52.8%), herniorrhaphies (20.0%) and excisions (15.2%). Almost half of children (48.8%) reported previous hospitalization and 33.6% reported previous surgical experiences. The parental sample was composed of 125 parents (109 mothers; 16 fathers), with a mean age of 39.01 years ($SD = 5.80$). The main demographical characteristics of the sample, from both children and parents, were similar for the three main group conditions (all $P > 0.05$) (see Table I). Due to non-significant differences between hospitals on all responses ($P > 0.10$), we did not include this variable in further analyses to safeguard the confidentiality of the hospitals.

Measures and materials

Demographic and clinic information. Age, gender, nationality, hospitalization history and type of surgery were obtained from parents or were provided by the hospital nursing services (through admission records).

Table I. *Demographic and clinical characteristics of participants by group condition*

	Total sample		Group						
			Experimental		Comparison		Control		
	($n = 125$)		($n = 45$)		($n = 45$)		($n = 35$)		
	n	%	*n*	%	*N*	%	*N*	%	χ^2
Child's Gender									1.474
Male	99	79.2	33	26.4	37	29.6	29	23.2	
Female	26	20.8	12	9.6	8	6.4	6	4.8	
Child's Ethnicity									9.225
Caucasian	85	68.0	32	25.6	24	19.2	29	23.2	
African	39	31.2	13	10.4	20	16.0	6	4.8	
Asian	1	0.8	0	0	1	0.8	0	0	
Child with previous hospitalization	61	48.8	22	17.6	21	16.8	18	14.4	0.179
Child with previous surgeries	42	33.6	17	13.6	13	10.4	12	9.6	0.807
Parental accompanying									0.196
Mother	109	87.2	40	32.0	39	31.2	30	24.0	
Father	16	12.8	5	4.0	6	4.8	5	4.0	
Parental schoolarity									0.130
Below grade 4	26	20.8	12	9.6	8	6.4	6	4.8	
Grades 5–6	11	8.8	5	4.0	2	1.6	4	3.2	
Grades 7–9	39	31.2	13	10.4	14	11.2	12	9.6	
Grades 10–12	30	24.0	10	8.0	15	12.0	5	4.0	
Bachelor's degree	1	0.8	0	0	1	0.8	0	0	
Graduate degree	18	14.4	5	4.0	5	4.0	8	6.4	
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***F***
Child' age	10.09	1.43	10.29	1.25	9.84	1.48	10.14	1.57	1.123
Child's grades	4.66	1.65	5.02	1.52	4.31	1.69	4.66	1.71	2.126
Parental age	39.01	5.80	38.93	5.42	37.78	5.83	40.69	5.97	2.545

Preoperative worries. To evaluate children's preoperative worries about surgery, hospitalization and medical procedures we used the Child Surgery Worries Questionnaire (CSWQ) [25], which is composed of 23 items. Children were asked to indicate the degree of worry regarding each statement using a five-point Likert scale response with a thermometer scale format (ranging from $0 =$ *not at all worried* to $4 =$ *extremely worried*). Higher scores correspond to higher worries about the surgery. The original version showed good reliability (Cronbach's alpha $= 0.88$) and construct validity [25]. In this study, we decided to evaluate only the global preoperative worries, since all the three factors were moderately correlated with each other ($rs > 0.60$), as well as highly correlated with the global score ($rs > 0.83$). The average score was calculated by summing all responses and dividing by the total number of items to facilitate the interpretation of results. Although the original CSWQ was administered to a sample of Spanish children, aged between 11 and 14 years old, other studies using Portuguese samples of children from 5 to 12 [20] and 8 to 12 years [21] also yielded high reliability scores. According to Chambers and Johnston [56], children over 6 years are able to understand the five-point response scale that is used in this study.

Parental anxiety. The State-Trait Anxiety Inventory-Form Y (STAI-Y) [57, 58] was used to evaluate parental preoperative anxiety state. STAI-Y is composed of two subscales (anxiety trait and state anxiety), each containing 20 items. In this study, only state anxiety was measured. Parents were asked to indicate, in a four-point scale (from $1 =$ *not at all* to $4 =$ *very much*), the way they were feeling at that moment (i.e. before surgery). The

responses to all items were summed into a single state anxiety score for each individual. Total scores could range from 20 to 80, with higher scores indicating greater state anxiety. Previous studies in Portugal have demonstrated the reliability and validity of the STAI-Y [20, 21, 58].

Child's temperament. The Emotionality, Activity and Sociability Temperament Survey for Children: Parental Ratings (EAS-P) [59] was used to assess children's temperament through parental report. The EAS-P is composed of 20 items that measure four temperamental dimensions: emotionality, activity, sociability and shyness. Responses can be expressed using a five-point Likert scale response format (from 1 = *not characteristic or typical of your child* to 5 = *very characteristic or typical of your child*). The reliability and validity of the EAS-P questionnaire were supported by other studies [32, 60].

Child's coping strategies. The Schoolagers' Coping Strategies Inventory: Parental Version (SCSI-P) [61, 62] was used to analyse child's coping strategies. We decided to adapt the original SCSI-P instrument into a hetero-report version for parents to avoid overloading the children with the completion of another questionnaire. SCSI-P is composed of two subscales, each containing 21 items: frequencies of certain actions that children engage when they are worried or anxious; and parental beliefs about the efficacy of these behaviors. Parents were asked to indicate, on a four-point scale, each statement applicability (from 0 = *never* to 3 = *most of the time*). The Portuguese adaptation, based on a sample of 291 Portuguese children, also suggests three dimensions in the frequency subscale. The final scores of both subscales can be obtained by the sum of each item (range between 0 and 63 points). In both original and Portuguese versions, the results showed good reliability [61, 62].

Educational materials. The educational materials were designed in three different formats—a booklet, a board game and a video (saved in a Windows Media format and run in a laptop), and they were all developed to provide the same information. These materials are composed of seven parts, illustrating the hospital stages: (i) Hospital admission; (ii) Healthcare professionals and hospital rules; (iii) Medical instruments; (iv) Medical procedures; (v) Anesthesia and Surgery room; (vi) Recovery room; and (vii) Aftercare and Going home. Each part is composed of clear explanations about specific topics and intervention stages (e.g. information about healthcare professionals, medical instruments, clinical procedures and induction of anesthesia), as well as explanations of specific hospital and medical rules (e.g. reasons why they should not eat or drink before surgery, the changing of clothes and parental separation during surgery). Exactly the same educational information was provided through text and pictures, some of them to be color (booklet); game cards (board game); or scripts of the scenes filmed in one hospital with children actors (video) (see Appendix 1). All the materials were designed to last 15–20 min. A previous pilot study ($n = 490$) was conducted to select the content of the materials. This study, conducted in different schools in the Lisbon metropolitan area, with children aged between 7 and 12 years ($M = 9.22$; $SD = 1.52$), also contributed to gather information about the child's beliefs and fears about surgery. In addition, several meetings with healthcare professionals were also conducted to determine and improve the content of the educational materials [21].

Entertainment materials. We used entertainment materials in the same three formats (i.e. a booklet, a video and a board game) in the comparison group (i.e. Entertainment Material Group). A Calvin and Hobbes comic strips, a Tom and Jerry cartoon movie and a classic Snakes and Ladders board game were the entertainment materials chosen. They also lasted about 15 min.

Emotions. Whilst the children were engaging with the different educational/entertainment material they were asked to report how they were feeling by choosing a drawing depicting emotional facial expressions of sadness, happiness, anger and fear. This evaluation occurred at the end of each section of the educational materials, and at the beginning and end of exposure to the entertainment materials. The drawings of the facial expressions were also previously tested in the previous pilot study mentioned above [21].

Procedure

The healthcare professionals working in the pediatric surgery unit of the hospitals were briefed beforehand about all the details. On the day of surgery and immediately after the hospital admission, informed consents for parents were requested. Parents were initially informed that this study aimed to evaluate children's cognitive and affective responses regarding surgery. Children also provided assent and all agreed to participate. All participants were guaranteed anonymity. The study was conducted only after the hospital admission to ensure that all participants would undergo surgery on that day. Before any intervention, demographic and clinical information about the participants were obtained. (Additional measures of affective—arousal, valence, pain—and physiological responses—blood pressure, heart rate—were collected in this project, which will not be reviewed in this article because it was not clear whether providing information on surgery and hospitalization should influence them. Thus, we included these variables for exploratory analysis. Nonetheless, we summarize here information on these measures and their main findings. Blood pressure and heart rate frequency were obtained using a pulse monitor device (Omron's brand) that was placed on the wrist before collecting any other measure (baseline). Children were also asked to indicate how aroused versus calm (arousal dimension), and how happy versus sad (valence dimension) they were feeling using the Self-Assessment Maniquin scales [63]. The Wong-Baker Faces Scale [64] was used to assess the amount of pain they were experiencing. All these additional measures were collected during the pre- and post-operative period (three phases: baseline, after the experimental intervention and after the surgery). Each measure was scored twice (post-intervention and post-surgery) as the mean values collected after the experimental intervention and after the surgery subtracted by the mean values at baseline. Using a 3 (group condition) × 2 (operative period: post-intervention, post-surgery) factorial design, five independent ANOVAs were conducted. No main effects of group condition and no significant interactions involving group × operative period were found for any of these responses. Regarding group condition, $F(2, 109)$ test values ranged from 0.52 ($P = 0.595$, $\eta_p^2 = 0.01$, for blood pressure) to 1.88 ($P = 0.158$, $\eta_p^2 = 0.03$, for arousal); $F(2, 109)$ test values for group × operative period ranged from 0.13 ($P = 0.880$, $\eta_p^2 = 0.002$, for arousal) to 3.06 ($P = 0.052$, $\eta_p^2 = 0.05$, for heart rate frequency). Thus, for the sake of simplicity these variables were not addressed in the literature review and they will not be discussed further.) Participants (children and parents) were randomly assigned to seven independent conditions that were combined into the following three main groups: the Experimental Group ($n = 45$), the Comparison Group ($n = 45$) and the Control Group ($n = 35$) (Fig. 1). The random assignment of participants was accomplished *a priori* by using the Research Randomizer online tool at http://www.randomizer.org/form.htm. Note that children were randomly assigned to one of the seven conditions, and therefore those in the experimental or in the comparison groups received only one of the three types of materials (i.e. a booklet, a board game or a video). It was also previously established that children scheduled for surgery on the same day, in the same hospital, and in the same preoperative ward room, would share the same group condition despite the results of the random assignment tool. This decision was made before any contact between the researcher and the participants because of ethical concerns, i.e. children (or parents) might feel devalued if they would have notice that another child received a different treatment. This procedure only occurred in 9.6% of the sample and affected all groups, reducing a potential selection threat.

Immediately after the experimental intervention, children's preoperative worries were evaluated using the CSWQ. At the same time, parents were asked to report their own state anxiety using the STAI-Y and to evaluate the temperament and coping strategies of their child, using the EAS-P and SCSI-P (see Fig. 1). The decision to ask parents to assess their children's temperament and coping strategies was made to avoid overloading the child with more instruments and questionnaires.

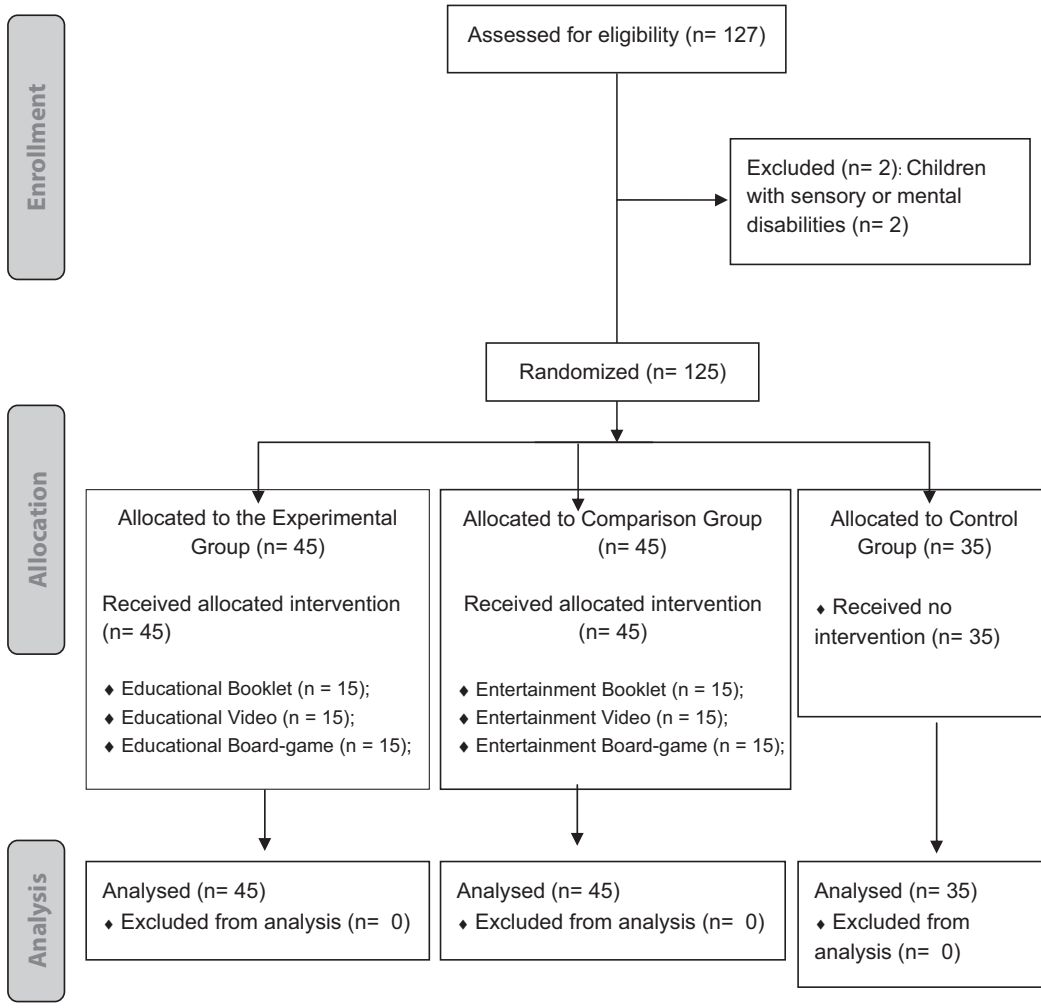

Fig. 1. Flow diagram of the randomized allocation of participants to groups based on the Consort 2010 Group.

All participants underwent the same procedures. Both educational and entertainment materials were administered by a psychologist, after the hospital admission and when children were already in their own bed in the preoperative ward room, waiting for surgery. Parents remained with the child during the preoperative and post-operative periods, and they were present throughout the process in all conditions. The entire questionnaires took around 10 min for children and 15 min for parents.

In the post-operative period, children received a certificate of bravery and parents were debriefed regarding the specific aims of the study (i.e. to test the efficacy of preoperative materials, by examining their effects on the children and parental responses). Parents were also informed that they could request to exclude their data from the analyses, but no parent requested it.

Results

Data were analysed by using IBM SPSS Statistics 20 for Windows. The data set used in this study had

Table II. *Descriptive statistics and alpha coefficients of the measuring instruments*

	No. items	Range	*M*	SD	α
Preoperative worries (CSWQ)	23	0–4	1.11	0.64	0.88
Temperament (EAS-P)	16		–	–	
Shyness	4	1–5	1.98	0.87	0.77
Emotionality	5	1–5	3.05	1.18	0.85
Activity	4	1–5	3.85	1.05	0.83
Sociability	3	1–5	4.25	0.74	0.66
Coping (SCSI-P)					
Acting out strategies	5	0–15	2.18	2.93	0.86
Distraction strategies	6	0–18	6.99	4.09	0.80
Isolating strategies	5	0–15	4.96	3.73	0.78
Parental anxiety (STAI-Y)	20	20–80	38.51	11.61	0.93

Note CSWQ: Child Surgery Worries Questionnaire; EAS-P: Emotionality, Activity, and Sociability Temperament Survey for Children: Parental Ratings; SCSI-P: The Schoolagers' Coping Strategies Inventory: Parental Version; STAI-T: The State-Trait Anxiety Inventory–Form Y.

only two missing value due to non-responses in one item of the STAY-Y, which were replaced by the participant's average.

Descriptive data and reliability of measurements

Descriptive statistics and alpha coefficients of the measuring instruments are presented in Table II. Internal consistencies of each scale were examined as indexes of reliability. Cronbach's coefficient alpha was 0.88 for the 23 items of CWQS and 0.93 for the 20 items of the STAI-Y, suggesting a high reliability for the both measures.

Because the child's temperament and coping strategies were measured by parent reports, a PCA with varimax rotation on the results of the EAS-P and SCSI-P questionnaires were conducted to examine their factor structure. For the EAS-P, the sampling adequacy was guaranteed, as indicated by the Kaiser Meyer Olkin (KMO) = 0.80 and the Bartlett's test of sphericity, χ^2 (120) = 922.690, $P < 0.001$. Four rotated factors were extracted with eigenvalues above 1 (Kaiser's criteria), and meaningful factor loadings (i.e. >|0.30|), that accounted for 65.45% of the total variance. Similar to the original instrument, the following factors were extracted: *Emotionality* (five items: 2, 6, 11, 15 and 19; $\alpha = 0.85$); *Activity* (four items: 7, 9, 13 and 17; $\alpha = 0.83$); *Shyness* (four items: 8, 12, 14 and 20; $\alpha = 0.77$); and *Sociability* (three items: 3, 5 and 10; $\alpha = 0.66$). However, four of the original items (1, 4, 16 and 18) were eliminated because of lower factor loadings or cross-loading on different factors. The sampling adequacy of the SCSI-P was also guaranteed (KMO = 0.75; Bartlett's test = χ^2 (120) = 822.889, $P < 0.001$). The following three factors were extracted with eigenvalues >1 and factor loadings >0|.30|, that accounted for 59.37% of the total variance: *Acting out strategies* (five items: 9, 10, 11, 12 and 21; $\alpha = 0.86$); *Distraction strategies* (six items: 4, 6, 7, 13, 19 and 20; $\alpha = 0.80$); and *Isolating strategies* (five items: 1, 2, 3, 17 and 18; $\alpha = 0.78$). Five items of the original SCSI-P (5, 8, 14, 15 and 16) were eliminated because of low factor loadings and cross loadings.

Children's preoperative worries about surgery as a function of group condition

To determine the effects of the experimental interventions on children's preoperative worries, the following six planned contrasts were conducted: three contrasts between the three main group conditions (experimental versus comparison versus control); and another three comparisons within the experimental group to test whether there were differences between the three types of material (board game versus video versus booklet). The means for each condition can be seen in Fig. 2 and the results of the

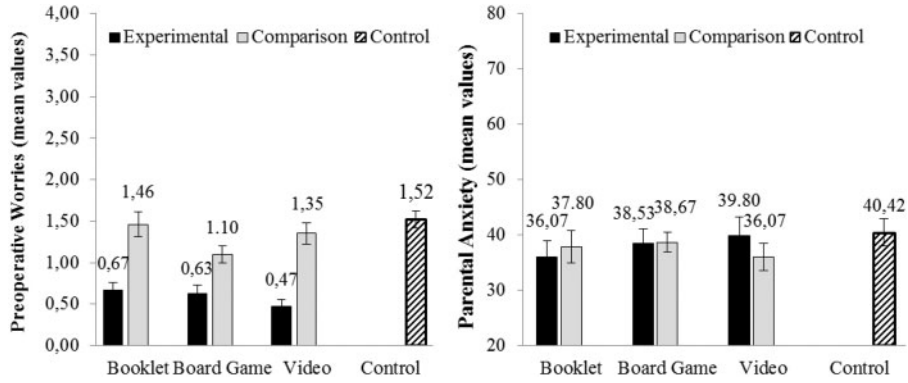

Fig. 2. Children's preoperative worries (left) and parental state anxiety (right) as a function of group condition and type of material. Error bars show the standard error of the mean.

planned contrasts are reported in Table III. Planned contrasts showed, as expected, that children in the experimental group reported statistically significant lower preoperative worries than children in both the comparison, $t(118) = -6.79$, $P < 0.001$, Cohen's $d = 1.43$; and the control group, $t(118) = -8.26$, $P < 0.001$, Cohen's $d = 1.86$; both hypotheses also demonstrated large effect sizes [46]. However, no statistical difference was found between the comparison and the control group ($P = 0.059$). Planned comparisons between the type of materials (board game, video, booklet) within the experimental group also revealed no statistical differences (all $P > 0.05$), indicating that all educational material seemed to display a similar important effect on children' worries.

Predictors of children preoperative worries

Bivariate correlational analyses were performed between the children preoperative worries and demographic (gender and age), clinical previous history, individual characteristics (temperament and coping strategies) and parental state anxiety, to examine for potential factors that might also predict preoperative child worries, in addition to the experimental intervention (see Table IV). A subsequent Hierarchical Multiple Regression (HMR) analysis was carried out to assess whether the set of variables that were found to be statistically correlated with the outcome (i.e. age, gender, emotionality, isolating coping and acting out coping strategies, all $P < 0.05$) would be still able to explain some variance in the child's preoperative worries, over and above the effect of the educational material intervention. Because no differences were found between the comparison and the control groups on children's worries, the group condition was dichotomized to examine the specific effects of providing information about surgery and hospitalization (Experimental group = 1) versus no information provided (Comparison and Control groups = 0). Again, to estimate if we would have the required sample size for running an HMR analysis, we used G*Power 3.2.3 [45] and a recent web-based calculator developed by Soper [65]. Both programs estimated a minimum of 92 participants when we used the following criteria: the inclusion of five additional set of independent predictor variables to the model, over and above the educational material intervention initial predictor, the Cohen's f^2 size of 0.15, probability level of 0.05, and 0.08 of power level. Thus, the minimum sample size requirement was ensured, and the HMR was performed. Multicollinearity was also not considered a problem for this analysis [tolerance values >0.80; variance inflation factor (VIF) <1.3]. The predictor variables were entered into the analysis in a two-stage step: the recoded group condition was entered at the first step, while age, gender, emotionality (temperament), isolating and acting out coping strategies were entered at step

Table III. *Planned contrasts for the children's preoperative worries and parental anxiety as a function of group conditions*

Contrasts	*t*	*gl*	*p*	*d*
Preoperative worries				
Experimental versus comparison	−6.79	118	0.000	1.43
Experimental vs. Control	−8.26	118	0.000	1.86
Comparison vs. Control	−1.91	118	0.059	0.43
Experimental: board game vs. booklet	−0.22	118	0.827	0.08
Experimental: board game vs. video	0.91	118	0.364	0.33
Experimental: booklet vs. video	1.13	118	0.261	0.41
Parental anxiety[a]				
Experimental + comparison versus control	−0.96	48	0.340	0.19
Experimental versus comparison	0.28	74	0.781	0.06

Note. [a]For parental anxiety, *t*-test values for unequal variances were reported because $P = .036$ for the Levene's test.

Table IV. *Zero-order correlations between the predictor variables, the child's preoperative worries and parental state anxiety*

	Global worries	Parental anxiety
Child's age	−0.21*	−0.17
Child's gender	−0.24**	−0.01
Previous hospitalizations	−0.12	−0.17
Previous surgeries	−0.15	−0.15
Parental anxiety (STAI-Y)	0.16	–
Shyness (EAS-P)	0.08	0.25**
Emotionality (EAS-P)	0.21*	0.22*
Activity (EAS-P)	−0.10	−0.09
Sociability (EAS-P)	−0.01	−0.08
Distraction strategies (SCSI-P)	0.02	−0.02
Isolating strategies (SCSI-P)	0.29**	0.17
Acting out strategies (SCSI-P)	0.18*	0.08

Note. $*P < 0.05$; $**P < 0.01$; $***P < 0.001$; Child's gender (male = 1, female = 2); CSWQ: Child Surgery Worries Questionnaire; EAS-P: Emotionality, Activity, and Sociability Temperament Survey for Children: Parental Ratings; SCSI-P: The Schoolagers' Coping Strategies Inventory: Parental Version; STAI-Y: State-Trait Anxiety Inventory–Form Y; Higher values indicate higher worries about surgery, pain perception, shyness, emotionality, activity, sociability, use of distraction, isolating and acting out coping strategies, parental state anxiety, number of previous hospitalizations and surgeries.

two. As can be seen in Table V, the HMR showed that the educational material intervention contributed significantly to the regression model, $F(1, 123) = 73.053$, $P < 0.001$, accounting for 37% of the variance in children's worries. The inclusion of the other set of five individual variables to the model in the second step increased the explanation significantly, with an additional 7% of the variance in preoperative worries, after statistically controlling for the educational interventions effect, F_{change} (5, 118) = 4.20, $P = 0.001$. However, when analysing the unique contribution of each variable, we found that only gender had a statistically significant contribution ($\beta = 0.15$, $t = 2.492$, $P = 0.014$), besides the educational material intervention ($\beta = 0.56$, $t = 8.577$, $p < 0.001$). Although the bivariate linear correlations between preoperative worries and age, emotionality, isolating and acting out strategies were statistically different from zero, these variables did not contribute significantly to the regression. Overall, the results have shown that providing educational information accounted for more than a third of the variability in reducing children's worries, but being male ($\beta = 0.15$, $t = 2.49$, $P = 0.014$) seems to also be a significant contributor to these reduced levels of the child's preoperative worries.

Children' specific emotions (i.e. happiness, sadness, fear and anger)

In addition to the above main analyses, we also collected information on children's emotions throughout the different sections of the educational materials. The emotion most reported by children throughout the different parts of the educational materials was happiness. Initially, 55.6% of children

Table V. *Results of HMR analysis to predict preoperative worries*

	Unstandardized coefficients		Standardized coefficients				
Variables	*B*	*SE*	Beta	*t*	R^2	ΔR^2	ΔF
Step 1					0.37	0.37	73.05***
Group	−0.81	0.09	−0.61	−8.55***			
					$F(1, 123) = 73.05$***		
Step 2					0.47	0.44	4.20***
Group	−0.73	0.09	−0.56	−8.06***			
Child's gender	−0.24	0.11	−0.15	−2.24*			
Child's age	−0.04	0.03	−0.09	−1.35			
Isolating_act	0.02	0.01	0.12	1.67			
Agressive act	0.02	0.02	0.08	1.16			
Emotionality	0.06	0.04	0.12	1.59			
					$F(6, 118) = 17.27$ ***		

Note. *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; Group (experimental = 1, comparison + control = 0); Child's gender (male = 1, female = 2).

choose happiness and at the end of the activities this percentage increased to 88.9%. Children in the comparison group also evaluated their emotions at the beginning and the end of the entertainment activities. Similarly, in this group, there was a statistically significant increase of happiness from the beginning (57.8%) to the end (91.1%) of the activities. In contrast, there was a decrease in fear reported by children in both groups (see Fig. 3).

Parental state anxiety as a function of group condition

The effects of group intervention on parental state anxiety were also analysed using planned contrasts, in which comparisons were made between the experimental and the comparison groups versus the control group; and also between the experimental and the comparison group (see Table III and Fig. 2). Contrary to expectations, there were no statistically significant differences for parental anxiety on the two planned comparisons.

Discussion

Preparing children for hospitalization and medical procedures is recognized to be an important way to minimize the negative impact of medical treatments since the mid-twentieth century [1]. This need is particularly relevant in cases of surgery [66], especially for outpatient surgeries, because the time spent at the hospital is reduced and the opportunities of the healthcare professionals to provide accurate information to patients are restricted [67–69]. Several factors may contribute to children's negative responses to the hospitalization experience: such as the anticipation of pain; the perception of danger; fear related to hospital procedures and surgical instruments; loss of control; unfamiliar routines and people; separation from parents; and parental anxiety [7, 11, 24]. A previous study demonstrates that a preoperative informational book educated the children and provided the benefit of reducing anxiety in the children [70]. Similarly, studies conducted with preoperative educational modeling videos also reveal a positive effect on children's anxiety relief and a reduction on postoperative maladaptive behaviors [66]. A preoperative educational video can also provide educational and anxiolytic benefits for parents, increasing their knowledge and reducing the parental state of anxiety [71]. Despite the fact that games are increasingly being used by health care providers to facilitate patient care, to our knowledge no research has been conducted using a preoperative educational board game to prepare children about forthcoming surgery.

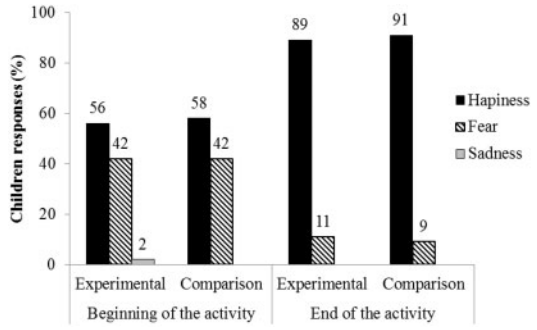

Fig. 3. Emotions reported by children in the experimental and comparison groups at the beginning and the end of the activity.

Because the access to information about heath, illness, body and medical procedures is largely recognized as one of the fundamental rights of every child in a clinical context [72], we developed educational preoperative materials in three different formats to be used by children in hospital settings. Although educational materials are considered the most effective preoperative preparation for children in the concrete operational stage of development [12], this study is the first experimental research that was conducted to analyse and compare the effects of preoperative interventions using different type of formats.

Research also suggests that many other factors may influence children's preoperative responses besides preoperative preparation, such as the child's age, cognitive development, previous surgical experiences, family support, pathology/illness and type of surgical intervention [1, 68, 73]. Taking these factors into account, we decided to collect a restricted sample, composed of children from 8 to 12 years, undergoing a pediatric outpatient surgery.

In an attempt to address the lack of research on testing different preoperative materials, this study aimed to develop different educational materials and analyse their efficacy on children's preoperative responses.

According to the Information Provision Model [14] that combines both the self-regulation and the schema-script theories, providing information about surgical procedures allows children to identify the most relevant and appropriate schemata to cope with events. In our study, we focused on children's worries, and our main results indicated that educational information materials contributed to minimize children's preoperative worries, thus confirming our initial hypothesis: children who received preoperative educational information reported less worries, compared to those that were only entertained and to those who did not received any material. These results are in line with other studies suggesting that providing children with preoperative information may decrease child's unrealistic expectations, inappropriate beliefs and concerns related to hospitalization and surgery [14, 74]. Thus, it is possible that this type of intervention worked because the materials have taught children what to expect in each phase, which in turn may have contributed to increase their confidence [1, 12, 74] and to use appropriate coping skills [11, 40]. Nevertheless, additional studies should test the processes that may contribute to explain the positive effects of educational material on preoperative worries. For this study, we decided to introduce a contextualized outcome measure by examining the effects of preoperative interventions on children's specific worries about surgery and hospitalization. However, many previous studies have analysed preoperative program effects using more global outcomes, such as the children's anxiety levels. Thus, in our view, our findings ought to be replicated and complemented with traditional measures of anxiety and of behavioral responses.

Children in this study also reported a relatively low level of preoperative worries, regardless of group condition, which indicates that outpatient surgeries does not produce strong concerns on children. However, the large effect size obtained in our study when comparing group conditions is particular important because this statistical measure is less sensitive to changes in sample size than the *P*-value, i.e. the estimated probability of rejecting the null hypothesis [46, 75], which suggest that the effect might be large enough to be clinically relevant.

The results of the regression model also suggest that providing educative information, regardless the format of the information, predicts less preoperative

worries about surgery, even when controlling for the child's age, temperament and coping strategies. These results replicate the findings from another study [21], demonstrating that educational preoperative materials can be an important predictor to minimize children's preoperative worries. In addition, the results showed that gender was also an important predictor, contributing beyond what was accounted for by the educative materials. These findings are in line with the literature, which suggests that males' patients tend to report lower levels of worry compared to females [25, 27, 76]. Regarding the other potential predictors, statistically significant bivariate correlations were found between preoperative worries and age, emotional temperament and coping strategies. However, these variables had no effects over and above the impact of the educational materials on preoperative worries. A possible explanation for these non-significant results may be related to the age range of the sample which was small and covered children with the same concrete operational stage of cognitive development. Another possible explanation could be related to the way the coping strategies and the temperament were measured (i.e. by heteroevaluation). Parents could have assumed, for example, that children use certain coping strategies when feeling stressed that might be different from those that children actually use. However, the decision to ask parents about their children's temperament and coping strategies was previously taken to not overload the child with more instruments. Temperament and coping may also function as moderators on the relationship between participating in preoperative preparation programs and preoperative worries [12, 38, 39, 74]. Analyses of moderation could be addressed in future studies using self-evaluation measures administered in separated phases, and using a larger sample to allow this type of analysis.

Another interesting finding in our study was that in both experimental and comparison groups most children reported feeling happy. Although the anticipation of surgery can bring stress, outpatient surgeries tend to be a less distressing experience than surgeries with unplanned admissions [77]. Confirming our initial hypothesis, after the application of both educational and entertainment materials, there was an increase in the percentage of children that reported feeling happy.

Preoperative anxiety in parents is a common phenomenon that has been associated with a higher incidence of a child's negative behaviors [5, 24]. It is possible that parents may feel guilty or responsible for putting their child through the stress of the surgical procedure [12]. Several authors emphasize the inclusion of parents during preoperative preparation, which may be extremely important for both children and parents [7, 15]. Contrary to our expectations, the effects of preoperative materials on parental state anxiety were statistically non-significant. In general, parents reported low state anxiety maybe because they perceived the risk of outpatient surgery as being low. The results of a previous study [21] also suggested that parents tend to feel less anxious when watching their child engaged in an activity, regardless of whether if it was educational or entertainment. It would be also interesting in future studies to examine the potential effects of different levels and methods of parental involvement in the child's preoperative program. Another suggestion is to evaluate the effects of the preoperative materials specifically designed for parents [29].

A wide variety of approaches have been proposed to minimize the potential negative effects of surgery and hospitalization, in particular the use of toys and other entertainment materials [12, 78–80], including music [81, 82], humor [83], magic [84], hospital clowns [20, 85], guided visits to the hospital and operating room [86] and educational preoperative programs [11, 66, 73, 87]. The literature also recommends that preoperative instruments should be brief, portable, inexpensive and easy to administer [88]. In this line, we developed preoperative educational materials in three different formats, using either photographs or drawings as explanatory figures, which symbolized patients, families and healthcare professionals, to allow their identification with the models [14, 17, 89]. Future research using larger samples may be useful to examine the effect of materials' format in more detail.

Ideally, the preparation for surgery should be administered about 2–4 weeks before the surgical

intervention [12]. However, due to the internal organization of hospitals, the preoperative preparation was only possible to perform at the same day of surgery. Nevertheless, in future studies, it would be relevant to assess the child's preoperative worries several days before the surgery and compare their responses to their thoughts at the day of surgery. Furthermore, it would important to evaluate the effects of preoperative programs on children undergoing other type of surgery and other invasive or painful medical procedures.

In general, Portuguese hospitals lack preoperative preparation materials properly developed and tested to provide educational information to minimize the potential anxiety and worry of children and their caregivers. Moreover, the three formats will be available in Portuguese hospitals and children may choose the format they prefer to use to obtain preoperative information. It is also important to highlight that the materials' developed, also because of their short application time, proved to be recommended in cases of outpatient surgery, where the time is strait.

To sum up, this study reinforced the importance of providing preoperative information to minimize children's preoperative worries, regardless their gender, age, previous surgical experiences, temperament and coping dispositions. A significant body of literature supports the need for every pediatric hospital to implement preoperative programs for patients. In fact, preoperative programs, when used appropriately, have several benefits for children and potential positive effects for the parents and healthcare professionals involved in the surgical experience [14, 15].

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Conflict of interest statement

None declared.

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Appendix

Table AI. *Texts from the educational preoperative materials*

1. Hospital admission
Welcome to **Adventure at the Hospital**! Do you know what part of your body that needs help? If you do not know, ask your parents and point it in the picture.
Remember: The surgery will make you feel even better!
2. Healthcare staff and hospital rules
We are going to explore the hospital together! There are many children. Some will be operated on, just like you! The hospital is a very clean and busy place, with a team of health professionals who are eager to meet you! As a game, there are some rules to follow so everything goes well!
1st Rule—You cannot eat or drink before surgery. As you are going to sleep, your stomach will not be able to digest anything. So it must to be empty so you do not feel sick.
2nd Rule—Change your clothes and dress in special pajamas for this special time!
3. Medical instruments
In the hospital there are some very strange objects . . . Come find out what they are for:
Thermometer—This measures your temperature to see if you have fever. It can be used under the arm, in the mouth or ear.
Stethoscope—This allows the doctor to hear better the sounds of your heart and lungs.
Scale—This measures your weight. Just step on it!
Blood pressure monitor—It measures the blood pressure in your arm. They put a special fabric balloon on your arm that will tighten a little.
Saturometer—It is a kind of special kind of flashlight (torch) that measures the oxygen levels in your blood to see if you are breathing well. Just put a clip with a red light on your finger.
Electrodes—These are little stickers which go on your chest and allow us to know how your heart is beating.
4. Medical procedures
They can also put on your hand a bandage with some white cream. It does not hurt but you will feel your hand get a bit colder and it will feel like it is asleep.
3rd Rule—If you have a sticker like this, remember that you cannot remove it! Sometimes you may need to take some special syrup. It helps you feel more comfortable and relaxed. There is also free time to play and ask any questions you want.
5. Anesthesia and Surgery room
After saying ‘bye bye’ to your parents, you will get to see the operating room. The operating room is a very clean place, full of lights and special machines. It looks like a spaceship. In this room there will be all the nice people you saw before but in this room everybody gets to play dress up. They will all have caps on their heads, masks covering their mouths, gloves on their hands and even special shoes. They are all dressed like this to keep the room and all stuff inside it clean.

(continued)

Table AI. *Continued*

In this phase you will sleep a little. You only have to breathe the air of a special mask. It is special because the mask is hooked up to a balloon with special air called anesthesia in it. This special air will help you sleep.
Do not forget that during the surgery you are going to be sleeping and you will not feel anything.
6. Recovery room
After the surgery you are going to wake up beside your parents! Because you slept a lot, it is normal to feel a bit dizzy.
4th Rule—You have to wait a little bit after you wake up. Then, the will say that you can drink some water or even have some juice and crackers!
7. Aftercare and Going home
Way to go! Your parents and everyone in the hospital will be very proud of you!
We are sure that you will be a true champion! Finally you will be able to go home. Do not forget to tell all your friends about your **Adventure at the Hospital**.