Efeitos de Preparações Psicológicas Pré-Cirúrgicas sobre o Estresse e a Ansiedade de Meninos e Meninas

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Resumo

A preparação infantil para a cirurgia é foco de atenção da equipe de saúde pelo potencial traumático dos procedimentos cirúrgicos e por ser fonte de estresse e ansiedade na infância. O impacto de três preparações psicológicas pré-cirúrgicas sobre o estresse e a ansiedade de crianças submetidas a cirurgias eletivas foi avaliado. A amostra foi composta por 80 crianças de um hospital infantil, a qual foi dividida em dois blocos de 40 sujeitos de acordo com o sexo e alocados aleatoriamente num dos quatro grupos: controle, preparação por informações verbais, preparação por jogo com kit de preparação ou preparação por vídeo informativo. O estresse e a ansiedade foram mensurados por meio da Escala de Stress Infantil (ESI) e do Inventário de Ansiedade Traço-Estado (Idate-C). A intervenção foi implementada em três etapas distintas: (a) aplicação da ESI e do Idate-C antes da preparação, no dia anterior a cirurgia; (b) a preparação propriamente dita nos grupos submetidos aos diferentes programas de preparação, também no dia anterior, e (c) a reaplicação da ESI e do Idate-C no dia da cirurgia. Os dados foram analisados por meio de equações de regressão simultâneas, e as estimativas são apresentadas em termos de diferença média padronizada e erro-padrão. Os resultados permitem inferir que a preparação com o vídeo reduziu o estresse ($T_{vídeo1}$ = -38 ± .18) e a ansiedade ($T_{vídeo2}$ = - .54 ± .27), especialmente entre os meninos ($T_{vídeoM1}$ = - .66 ± .25; $T_{videoM2}$ = - .71 ± .38). Implicações práticas para a preparação psicológica das crianças em situação pré-cirúrgica e limitações da pesquisa são discutidas.
Palavras-chave: Ansiedade pré-cirúrgica, cirurgia na infância, estresse pré-cirúrgico, preparação psicológica.

Efectos de la preparación psicológica prequirúrgica sobre el estrés y la ansiedad en niños y niñas

Resumen

La preparación infantil para una cirugía es el centro de atención del equipo de salud debido al potencial traumático de los procedimientos quirúrgicos y debido a que es una fuente de estrés y ansiedad en la infancia. En la presente investigación se evaluó el impacto de tres formas de preparación psicológica prequirúrgica ante el estrés y la ansiedad de los niños sometidos a cirugía electiva. La muestra estuvo constituida por 80 niños de un hospital infantil, divididos en dos bloques de 40 sujetos según el sexo, y asignados al azar a uno de cuatro grupos: control, preparación a través de información verbal, preparación a través de juego con el kit de preparación, o preparación a través de video informativo. Se utilizó la Escala de Estrés Infantil (ESI) y el Inventario Ansiedad Estado-Rasgo para niños (STAIC) para medir el estrés y la ansiedad de los niños. La intervención se llevó a cabo en tres etapas distintas: (a) aplicación del ESI y el STAIC antes de la preparación, el día anterior a la cirugía; (b) preparación propiamente dicha en los grupos de los diferentes programas de preparación el día anterior; y (c) reaplicación del ESI-C y el STAIC el día de la cirugía. El análisis de los datos se hizo mediante ecuaciones de regresión simultáneas y las estimaciones se presentan por medio de la diferencia entre medias estandarizada y de la desviación estándar. Los resultados permiten inferir que la preparación con video redujo el estrés (Tvideo1 = -.38 ± .18) y la ansiedad (Tvideo2 = -.54 ± .27), especialmente en los niños (TvideoM1 = -.66 ± .25; TvideoM2 = -.71 ± .38). Al final se discuten las implicaciones prácticas para la preparación psicológica de los niños en situación prequirúrgica y las limitaciones de la investigación.
Palabras clave: Preparación psicológica, estrés prequirúrgico, ansiedad prequirúrgica y cirugía en la infancia.

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Effects of pre-surgical psychological preparations on stress and anxiety in boys and girls

Abstract

Child preparation for surgery is a focus of attention of health teams due to the traumatic potential of surgical procedures and for being a source of stress and anxiety in childhood. The impact of three pre-surgical psychological preparations on stress and anxiety of children undergoing elective surgery were evaluated. The sample consisted of 80 children from a children's hospital, divided into two blocks of 40 subjects according to gender and randomly assigned to one of four groups: control, preparation by verbal information, preparation by game and preparation kit or preparation by informational video. Stress and anxiety were measured using the Escala de Stress Infantil (ESI) (Child Stress Scale) and the State-Trait Anxiety Inventory for Children (STAIC). The intervention was implemented in three distinct stages: a) application of ESI and STAIC before preparation, the day before surgery; b) actual preparation, in groups submitted to different preparation programs, also on the previous day; and c) reapplication of ESI and STAIC on the day of surgery. Data were analyzed using simultaneous regression equations, and estimates are presented in terms of standardized mean difference and standard error. Results allow to infer that preparation by video reduced stress (Tvideo1 = -0.38±0.18) and anxiety (Tvideo2 = -0.54±0.27), especially among boys (TvideoM1 = -0.66±0.25; TvideoM2 = -0.71±0.38). Practical implications for the psychological preparation of children in pre-surgical situations and the limitations of this study are discussed.
Key words: Psychological preparation, pre-surgical stress, pre-surgical anxiety and surgery in childhood.

INTRODUCTION

Psychological preparation of children undergoing surgery is one of the primary concerns of healthcare professionals. That is because children may experience high levels of stress and anxiety during the preoperative period due to a misunderstanding of what is happening. Studies indicate a connection between these phenomena and the increase in adverse postoperative clinical effects, which may leave permanent marks in their lives. Therefore, since the mid-twentieth century, several studies have recommended psychological pre-surgical preparation of children as an important health strategy (Carvalho & Almeida, 2014; Fincher, Shaw & Ramelet, 2011; Jaaniste, Hayes, & von Baeyer, 2007; O'Sullivan & Wong, 2013; Paladin, Carvalho & Almeida, 2014).

Stress is understood as a psychophysiological response of the organism caused by physical and psychological changes that occur when there is a confrontation of the subject with potentially irritating, frightening, exciting, euphoric or confusing situations (Lipp & Malagris, 1998). Several factors may contribute to the increase of child stress during the operative period: lack of familiarity with the hospital setting, anesthesia, surgery, pain, among others (Aouad, 2011). Anxiety, in turn, which is very common in the context of the preoperative period (Perry, Hooper, & Masiongale, 2012), is characterized as a fear that cannot be identified with a real object. There are external agents that may cause anxiety, but the internal triggers (memories of previous experiences, ideas, personal fantasies) and their degree of intensity will determine the anxiety reaction that can manifest itself as a state of restlessness that progressively increases (Fernandes, Arriaga & Esteves, 2014a).

Preventive measures aimed at reducing child's psychological stress, anxiety and hospitalization time are the best way to avoid negative postoperative consequences. Several strategies and tools have already been created and their effectiveness tested for this purpose, from simple and inexpensive measures to fairly sophisticated and costly instruments. Educational information, for instance, can be transmitted verbally or by providing models for children with the help of dolls and hospital toys or videos (Aouad, 2011; Fernandes, *et al*., 2014b; Fincher *et al*. 2011). However, studies indicate that the effectiveness of these interventions varies according to multiple factors, from the type of intervention offered, child's age, severity of clinical condition and length of hospitalization, to child's previous hospitalization experiences, their temperament and coping strategies (Yuki & Daaboul, 2011).

Among such measures, providing information is an intervention that attenuates anxiety and child stress by clarifying the procedures for the patient, which allows greater control over the situation (Perry *et al*. The way children use the preparatory information they receive prior to an operation is explained by the Information Provision Model proposed by Jaaniste *et al*. (2007). This model predicts that child's previous unique experiences, exposure to various and different sources of information, as well as individual characteristics (age, gender, and temperament, among others) influence the mental representation of the surgery memorized by the child.

Children may construct mental representations and narratives about surgery that are incoherent with reality, given their propensity for exaggeration and distortion of reality. Those who do not have previous experiences construct their representations and narratives about surgery using notions deemed relevant to cope with the situation. Therefore, providing clarifying and correct information about the hospitalization and surgery process to the child may assist them in building a more coherent and effective mental representation to deal with the challenging situation. Thus, the way information is communicated to the child is important, because if they are able to include it into an already existing narrative, it will be less threatening to face the new situation, which will produce less fear, anxiety and stress (Fernandes *et al*., 2014a; Jaaniste *et al*., 2007).

From the age of six, children benefit more when they receive psychological preparation between one week and five days before the surgical procedure (Jaaniste *et al*., 2007; Perry *et al* 2012). Although cognitive interventions are the most effective method of providing pre-surgical information for school-age children (O'Sullivan & Wong, 2013), the use of distraction methods may be useful when there is limited time and resources for an adequate provision of information. In such cases, the level of child stress and anxiety tend to decrease by redirecting child's attention from their own anxiety to entertain the distraction technique employed: toy, book, music, or video (Cuzzocrea, Gugliandolo, Larcan, Romeo, Turiaco, & Dominici, 2013; Fernandes, Arriaga, & Esteves, 2015). In the studies of Fernandes *et al*., (2014b; 2015) and Melamed and Siegel (1975), however, only children who received entertainment material containing pre-surgical educational information had their worries or fears about hospitalization and surgery reduced when compared to the control group and to the group that received only distraction material without any pre-surgical information. These results are consistent with the recommendation of Lambert, Glacken and McCarron (2013), that educational information be transmitted through entertainment materials.

Children aged seven to twelve may benefit by receiving specific information, using clear language and analogies about sensations (what they can feel, hear, see, smell and taste), symptoms, and length of surgery, through books , hospital toys and videos. However, when children receive general and/or insufficient information, they feel unprepared and worried about what will happen. Detailed information increases their knowledge, makes them more confident, with a certain sense of control of the situation, and will better prepare them to identify useful information to improve their idea regarding surgery, making their coping strategies more effective (Fernandes *et al*., 2014b; Jaaniste *et al*. 2007; Lambert *et al*., 2013).

A shortcoming found in the literature concerns the control of children's gender. Although studies indicate that anxiety and stress levels in boys are lower than in girls, there are no studies with sample blocking by child's gender to evaluate pre-surgical preparations (Fernandes *et al*., 2014b; Melamed & Siegel, 1975). Furthermore, in three recent studies found in the literature that tested child educational interventions, child anxiety and worry data were only collected after preparation (Cuzzocrea *et al*., 2013; Fernandes, *et al.* 2014b; 2015). In the study of Fincher *et al*. (2011) an evaluation of child anxiety before preparation was carried out, but results did not show statistically significant differences between the experimental group and the control group.

Based on these previous results, this study aimed to evaluate the impact of three types of psychological preparations with pre-surgical educational information on anxiety and stress in boys and girls undergoing elective surgeries. Elective surgeries are those in which children are discharged on the same day if there are no complications. Since they are scheduled surgeries, there is enough time to perform preoperative preparation. They are considered minor surgeries, which do not require much hospitalization time, but many of the implications regarding hospitalization also affect such children, not sparing them from the consequences that hospitalization may entail regardless of the time they remain in hospital.

Children were divided into gender-balanced blocks and randomly assigned to one of four groups: control (G1), verbal information (G2), pre-surgical preparation kit (G3) and explanatory video (G4). Three hypotheses were considered: (H1) children who received some pre-surgical psychological preparation would have lower post-intervention anxiety and stress measures than prior to preparation, when compared to the control group; (H2) among the three experimental conditions, the explanatory video group would show greater decrease in stress and anxiety levels, followed by the pre-surgical preparation kit group, and finally the verbal information group; (H3) girls would have higher initial stress and anxiety levels (Fernandes *et al*., 2014b; Melamed & Siegel, 1975) and would benefit the most from preparations.

METHOD

It is a randomized controlled study with parallel groups (a control group and three interventions), with block randomization based on child's gender, repeated measures (pre- and post-intervention), and allocation balanced by

experimental group and block. It is worth remembering that an experimental study does not necessarily have to consider sampling design, but a randomization and allocation plan.

Participants

This study was carried out in a children's hospital in the Vale do Itajaí region and approved by the Ethics Committee of the Federal University of Santa Catarina (n. 120.114). A total of 80 children participated in the study, 40 boys and 40 girls, aged 6 to 12 years, admitted to a children's hospital to undergo minor elective surgery. Primary sample characteristics and variable distribution by group, can be checked on the Table 1.

The following inclusion criteria were followed: children were between 6 and 12 years of age; scheduled for minor elective surgeries (tonsillectomy, adenoidectomy, hernia and postectomy); undergoing their first surgical intervention; submitted to the procedure through the Sistema Único de Saúde (SUS) (Brazilian Unified Health System); hospitalized the night before the procedure and discharged on the same day after recovery from anesthesia; accompanied by

Table 1.
*Sample Characteristics.**

	Contr. (G1)	Info. (G2)	Kit (G3)	Video (G4)	Total
N	20	20	20	20	80
Gender					
Male	10 (50%)	10 (50%)	10 (50%)	10 (50%)	40 (50%)
Female	10 (50%)	10 (50%)	10 (50%)	10 (50%)	40 (50%)
Age					
6 to 8 years	13 (65%)	10 (50%)	15 (75%)	11 (55%)	49 (61.3%)
9 to 10 years	5 (25%)	5 (25%)	3 (15%)	5 (25%)	18 (22.5%)
11 to 12 years	2 (10%)	5 (25%)	2 (10%)	4 (20%)	13 (16.2%)
Education Level					
Preschool	2 (10%)	2 (10%)	0 (0%)	3 (15%)	7 (8.7%)
1st and 2nd Grade	7 (35%)	3 (15%)	11 (55%)	5 (25%)	26 (32.5%)
3rd and 4th Grade	9 (45%)	9 (45%)	5 (25%)	8 (40%)	31 (38.8%)
5th and 6th Grade	1 (5%)	4 (20%)	3 (15%)	4 (20%)	12 (15.0%)
7th Grade	1 (5%)	2 (10%)	1 (5%)	0 (0%)	4 (5.0%)
Types of Surgery					
Inguinal hernia	7 (35%)	4 (20%)	6 (30%)	5 (25%)	22 (27.5%)
Tonsillectomy and adenoidectomy	8 (40%)	6 (30%)	3 (15%)	4 (20%)	21 (26.3%)
Adenoidectomy	4 (20%)	5 (25%)	3 (15%)	4 (20%)	16 (20.0%)
Postectomy	0 (0%)	2 (10%)	4 (20%)	4 (20%)	10 (12.5%)
Tonsillectomy	0 (0%)	3 (15%)	2 (10%)	2 (10%)	7 (8.7%)
Umbilical hernia	1 (5%)	0 (0%)	2 (10%)	1 (5%)	4 (5.0%)
ESI					
Pre-	33.7 (15.7)	45.2 (24.2)	31.6 (14.3)	44.2 (22.9)	38.7 (20.3)
Post-	29.5 (18.5)	39.8 (21.5)	24.7 (15.8)	30.6 (19.6)	31.2 (19.4)
STAIC					
Pre-	32.4 (4.2)	33.0 (3.2)	33.9 (4.0)	34.3 (4.9)	33.4 (4.1)
Post-	33.2 (4.9)	33.3 (4.1)	33.5 (5.6)	31.7 (3.6)	32.9 (4.6)

* Indicated proportions for category variables refer to the corresponding column total. ESI refers to Child Stress Scale and STAIC refers to State-Trait Anxiety Inventory for Children. Both outcome measures are presented in terms of mean and standard deviation.

a guardian who agreed to participate in the study by signing an informed consent form.

Children included in the sample were first divided into gender-balanced blocks. Then, they were randomly assigned to four groups, 20 children (10 boys and 10 girls) in each preparation group and 20 children in the control group. Sample sociodemographic characteristics were not significantly different among the four groups (all χ^2 tests obtained a p-value > .05). This experimental design is classified as *generalized randomized block design*, and allows to calculate the interaction between blocks (boys and girls) and interventions (verbal, pre-surgical preparation kit, explanatory video), evaluating the difference in the impact of treatments for each gender.

Instruments and Materials

Sociodemographic and clinical data. Age, gender, surgical history and type of surgery were obtained by consulting each patient's medical records at the hospital screening sector.

Child Stress. In order to assess children's stress before and after psychological preparation, the Child Stress Scale (ESI, by its acronym in Portuguese) was individually applied (Lipp & Lucarelli, 2005). The scale consists of 35 items that aim to represent situations with recognized potential to evoke the manifestation of physical (nine items) and psychological (nine items) reactions of child stress, as well as psychological reactions with a depressive component (nine items) and psychophysiological reactions (eight items). Responses to items are given using a five-point Likert scale. Cronbach's alpha of the instrument was .90.

Child Anxiety. In order to assess children's anxiety before and after psychological preparation, the state anxiety subscale (20 items) of the State-Trait Anxiety Inventory for children (STAIC), adapted for use in Brazil by Biaggio and Spielberger (1983), was individually applied. It indicates how the child feels at a given moment of time, measuring transient states of subjective, consciously perceived feelings of apprehension, tension, and worry that vary in intensity. Responses indicate frequency in four points: never, almost never, sometimes and often. Each item consists of three statements representing different symptom intensities. Cronbach's alpha was .88 for the scale used.

Educational material. Educational information was provided in three different formats. The *Information Group* (G2) received only *verbal information* individually, without any support material. The information consisted of telling the child the type of surgery and the stages they would go thorough during their surgical procedure: fasting, clothes and information about the surgical center, anesthesia ("sniffing"), breathing tube, bandage, recovery room, return to the bedroom and possible post-surgical side effects. The *Preparation Kit Group* (G3) received the same information along with a *pre-surgical preparation kit*, developed for this research and consisting of hospital supplies such as: stethoscope, surgical mask, doctor and child hospital pajamas, serum drip bag and infusion set, shoe cover, cotton, adhesive plaster roll, glove, syringe; and a surgical doll with miniature hospital supplies: stethoscope, glove, mask, shoe cover, pajamas, scissors, scalpel, thermometer and shovel. Finally, the *Video Group* (G4) received the same information through an *explanatory video* played on a notebook. This audiovisual resource in the form of a cartoon was prepared for the exclusive use of this research and previously approved by two specialists in the area and by 10 children of the same age as the study participants. In the video, a black boy is taken to the doctor by his parents and learns that he has to undergo surgery. The doctor tells the child about the steps he would go through during his surgical procedure. Since participants underwent four different types of surgical interventions and the video provided was the only one, information regarding the procedure was general, without any specificities of each surgery.

Procedures

Initial contact with the children was made the night before the surgical procedure, after the child was admitted to hospital. Such contact consisted of a previous interaction with the child and their guardian to establish a trust relationship with the researcher. Companion and child were then invited to participate in the research and each of them had to sign their own Free and Informed Consent Term. Once *rapport* was established, the first 10 children in each group completed ESI and STAIC. The order of application of the two instruments was reversed for the next 10 children. The instruments were applied in a room apart from the hospitalization room.

At first, the children of experimental groups (G2, G3, G4) were individually asked what they knew about their surgery, what they thought the procedure would be like, and what their doubts about it were. After that, they were informed about what would happen through one of the three psychological preparations. The information given to the child was obtained at the same hospital where the study was conducted, in order to maintain its truthfulness. The children in G2 received verbal information in approximately 30 minutes, the same duration of G3 preparation with the aid of a pre-surgical preparation kit. The children in G4 watched the explanatory video in about five minutes. During psychological preparation, the child was allowed to

ask questions about the information (G2, G3), the scenes watched (G4), and to manipulate the doll after receiving the information (G3), so that they were really sure about what they would go through, as recommended by Lambert *et al*. (2013). On the day of surgery, the second stage of data collection was conducted with the application of ESI and STAIC, in the same way as the previous night.

Data analysis

The data were analyzed using a multivariate linear regression equation system. Model equations make use of pre-intervention measures as covariates, allowing to reduce the standard error of estimates of the causal impact of interventions through a model similar to ANCOVA. The need to use a system of equations is due to the fact that the two outcome variables are correlated. In order to fit the model, the *seemingly unrelated equations* estimation technique was used, which considers the correlation between residual errors when there is more than one outcome and system equations do not have the same predictors.

$$y_{ikj}^{ESI} = \alpha_1 + \beta_1 X_i^{ESI} + B_{1k} + T_{1j} + \epsilon_{1i}$$

$$y_{ikj}^{IDATE} = \alpha_2 + \beta_2 X_i^{IDATE} + B_{2k} + T_{2j} + \epsilon_{2i}$$

$$\begin{pmatrix} \epsilon_{1i} \\ \epsilon_{\ i} \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_{ESI}^2 & \rho\sigma_{ESI}^2\sigma_{IDATE}^2 \\ \rho\sigma_{ESI}^2\sigma_{IDATE}^2 & \sigma_{IDATE}^2 \end{pmatrix} \right)$$

The basic equations to estimate interventions causal effect are described in Equation 1. The two outcome variables (y) indicate the standardized score after intervention; the intercepts (α) indicate the control group mean; the slopes (β) control the variation relative to standardized scores prior to intervention (X_i); block indicators (B_k) estimate the base variation between boys and girls; intervention type indicators (T_j) estimate the difference between treatments and the control group, which is the primary coefficient of interest in the study. Residual errors (ε) are modeled as coming from a normal multivariate distribution and correlated between outcomes.

Numerical variables were transformed into z-scores, centralizing the measure of the two moments in the mean of the pre-test measure and staggering by the aggregate standard deviation of the two moments. Such transformation allows to directly compare the coefficients of both outcomes and interpret the causal effect in terms of the difference between normalized means. Categorical variables were coded using *dummy coding*, with the control group as reference. Model parameters were estimated through the *systemfit* package (Henningsen & Hamann, 2007) of the *R* programming environment, Version 3.2.2.

However, the analyzes presented are based on the complete model, which complements Equation 1 by adding the terms of interaction between all predictors. Its main advantage is to allow an estimation of effect variation

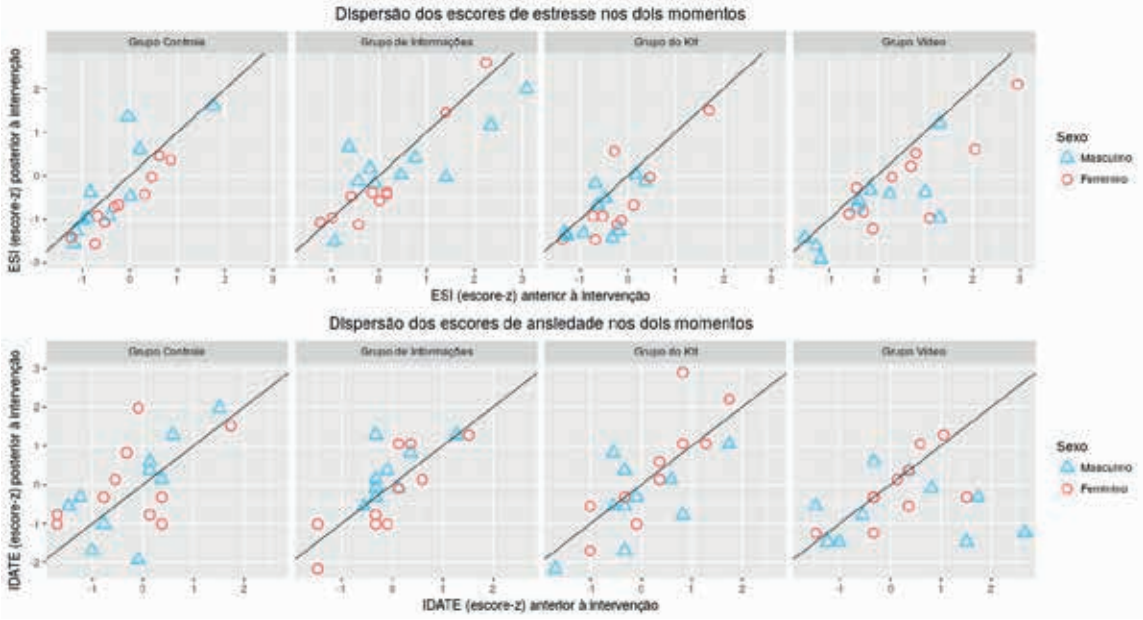

Figure 1. Scatter plot of stress (upper line) and anxiety measures (lower line). The x-axis indicates the values, in z-score, of pre-intervention measures; the y-axis, in turn, indicates post-intervention measures. Each column represents one of the groups of the study. Triangles indicate boys and circles indicate girls. The diagonal line represents the identity between the two moments: points below it suffered a decrease in score, and points above it increased.

as a function of block or pre-intervention score. The *R multcomp* package (Hothorn, Bretz & Westfall, 2008) was used to compute the difference between interventions and the control group marginalizing interactions. This package allows an estimation of multiple linear hypotheses based on regression models, taking into account the problem of multiple comparisons.

RESULTS

Results obtained from the analyzes performed will be presented below.

Dispersion of stress and anxiety measures in pre- and post-intervention moments can be seen in Figure 1, divided by experimental groups and control group. Consistent with the measures of central tendency, most points, especially among boys, are below the identity line in experimental groups, suggesting a decrease in relation to pre-test scores.

Estimates of causal effect inferred by the model will be presented in two parts. First, the average marginal effects of each treatment and their variation between boys and girls will be presented. Then, the effect variation estimates will be presented as a function of the pre-test score on the outcome variable.

Average effect and effect by blocks

Figure 2 shows the estimates of causal effect of the three preparations on stress and anxiety. This estimate is the difference of experimental groups mean compared to the control group.

Regarding stress measures, general effects of preparations by verbal information and by preparation kit were poor and with standard error, indicating uncertainty about effect direction (T_{info1} = +.09±.18; T_{kit1} = –.25±.19). The preparation that made use of the video, however, presents greater magnitude and more precise direction (T_{video1} = -.38 ± .18), indicating an effective decrease in stress for this experimental group.

When estimates of preparation effects on stress are disaggregated as a function of the blocks, it is possible to notice that boys showed a greater decrease in scores than girls. For boys, all effects were negative, but only the estimates of the preparation kit and video groups were of greater magnitude and right direction (T_{infoM1} = –.08±.27; T_{kitM1} = –.56±.29; $T_{videoM1}$ = –.66±.25). Girls, in turn, showed poor effects and of uncertain direction (T_{infoF1} = +.27±.25; T_{kitF1} = +.06±.26; $T_{videoF1}$ = –.1±.27).

The same pattern is repeated for the anxiety outcome. The overall impact of the preparations is poor and of

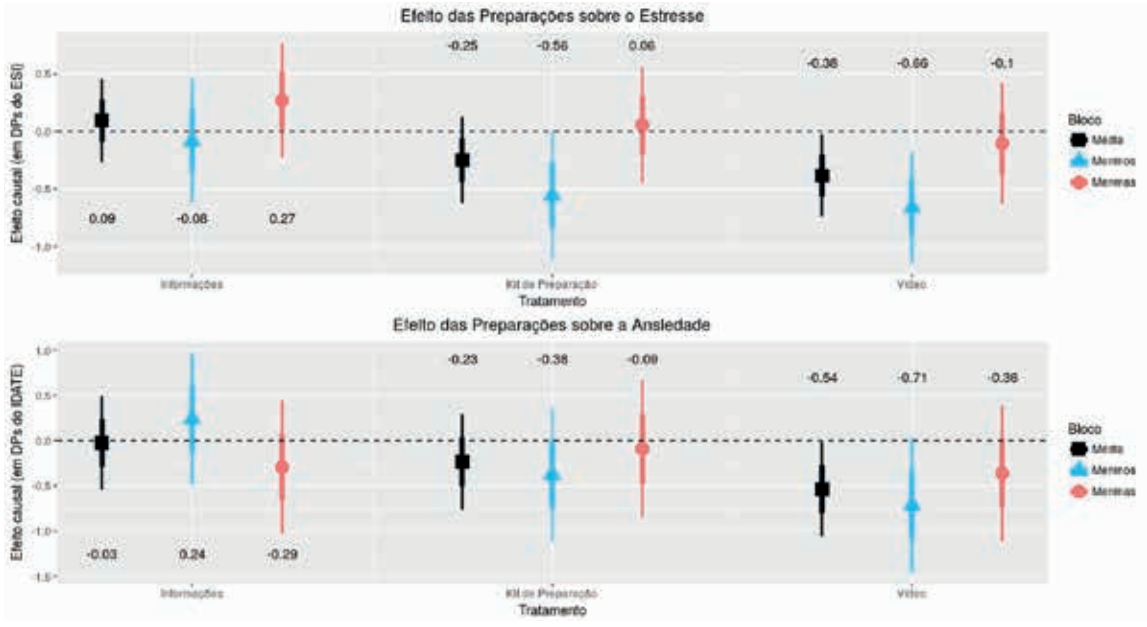

Figure 2. Estimates of causal effect of the three treatments on stress (top chart) and anxiety (bottom chart). Point estimates represent the mean difference in relation to the control group, both for the two blocks simultaneously (square), and separately for boys (triangle) and girls (circle). Thicker lines indicate the standard error of estimates, and thinner lines indicate the limits of the 95% confidence interval. The numbers above or below each element indicate the value of the parameter's point estimate.

uncertain direction for the information and preparation kit groups, but it is greater and negative for the video group (T_{Info2} = -.03 ± .26; T_{Kit2} = -.23 ± .27; T_{video2} = -.54 ± .27). Results indicate an effective reduction of anxiety for the experimental group prepared with the video.

Considering the effects disaggregated by block, boys again showed a greater reduction compared to girls. Among boys, the effects of information and preparation kit treatments are poor and of not very precise direction, while the video group effect has a greater magnitude (T_{infoM2} = +.24±.37; T_{kitM2} = –.38±.37; $T_{videoM2}$ = –.71±.38). For girls, all effects are close to zero, and the standard error of estimates indicates uncertainty about their directions (T_{infoF2} = -.29 ± .37; T_{kitF2} = -.09 ± .39; $T_{videoF2}$ = -.36 ± .38).

Effect variation as function of initial score

The interaction between intervention type and pre-test measure allows to evaluate the variation of the effect of the intervention as a function of the subject's initial score. The estimate of this variation is given by the equation $T_j + \beta_1 x$, that is, the average effect of the treatment j (T_j) added to the slope given by the interaction of the treatment variable with the pre-test measure (β_1) as a function of the pretest score (x).

1. Information Group: for the stress outcome, the expected difference between the control group and the information group is +.06 – .15x. The negative sign of the slope suggests that such treatment may benefit more those children with higher stress scores, but their estimate is uncertain to ensure such inferenceβ_{info1} = -.15 ± .2). For anxiety, the variation of the treatment effect is –.06 + .32x, which suggests a worsening among children with higher pretest scores. This inference is also not very precise due to the standard error of the estimate (β_{info2} = +.32±.34).

2. Pre-surgical preparation kit group: the variation in the effect of the preparation kit on stress is -.27 - .28x. The negative slope suggests a greater decrease among children with higher scores, but their estimate is uncertain (β_{kit1} = –.28±.25). For the anxiety outcome, effect variation is –.25 + .28x. The effect is apparently worse for children with higher anxiety in pretest, but slope estimate is imprecise (β_{kit2} = +.28±.29).

3. Explanatory video group: finally, the effect variation of preparation with explanatory video on stress is –.39 – .33x. Slope magnitude is strongly negative, suggesting that video treatment is particularly effective on children with higher levels of stress (β_{video1} = –.33±.19). For the anxiety outcome, treatment impact variation is –.55 – .37x. Slope direction suggests greater anxiety decrease for children with high pretest scores, but in this case the estimate is less precise (β_{video2} = –.37±.26).

Overall, treatment effect variation estimates suggest that there is little change in magnitude and direction of effect as a function of pre-preparation scores. The exception, although evidence is not decisive, is the amplified effect of video preparation on children with higher stress and anxiety.

Inference Sensitivity

In order to check if complete model inferences are robust, the coefficients presented above were compared with basic model estimates. Since the basic model has no interaction, its coefficients are related to the average intervention effect, disregarding variation between boys and girls.

Preparations causal effect is of low magnitude and uncertain direction for both the information group and the pre-surgical preparation kit group. For the first one, the average effect estimate is +.07±.18 for stress and -.05 ± 0.28 for anxiety. For the second group, the estimated causal effect is -.16 ± .17 and -.13 ± .28, respectively. Finally, the explanatory video group is the only intervention whose magnitude and direction are estimated with greater precision. The estimated effect is -.35 ± .17 for stress and -.61 ± .28 for anxiety, suggesting efficacy in reducing both outcomes.

Comparing these results with the complete model, the substantial conclusions obtained do not change much: the video group was the one with the greatest impact in reducing both anxiety and stress. The basic model, however, does not differentiate between boys and girls and calculates the average for both blocks; it also does not allow to check for variations in average effect as a function of previous score.

In order to ratify our preference for the complete model, both models were directly compared through the likelihood ratio test, and the result was statistically significant in favor of the complete model (χ^2 (20) = 42.34; p = .002), indicating that interactions improve fit to the data. The complete model is therefore corroborated by the simpler model in its most important inferences and is also better fitted to the data.

Finally, the complete model residual analyzes do not indicate any obvious violation of linear regression main assumptions.

DISCUSSION

The child may experience surgery as a traumatic event which generates high levels of stress and anxiety. For this reason, child preparation for this process is a focus of interest of the health team, especially considering the lack of time and opportunities to provide relevant information to the child in the preoperative period (Fernandes *et al*., 2015).

The initial hypothesis (H1) that children who received some pre-surgical psychological preparation would have lower post-intervention anxiety and stress measures than prior to the intervention, compared to control group variation, was partially corroborated. The estimation of experimental groups average effects are almost all negative, although many of them do not allow to confidently infer effect direction. The video group was the only experimental group whose effect was estimated with greater precision, indicating an effective decrease in stress and anxiety. Gender-based effect analysis suggests that boys benefit more from preparations than girls. Effect variation analysis as a function of initial scores also suggests that video preparation may be particularly beneficial to children with higher levels of stress and anxiety.

The second hypothesis (H2), that children who watched the explanatory video would have greater decrease in stress and anxiety levels compared to the pre-surgical preparation kit ones, which would in turn have lower levels than those in the verbal information group, was partially corroborated. Although differences between experimental groups are slight, effects' order of magnitude followed the predicted pattern in aggregate estimates and in the boys block. For girls, video preparation showed the greatest decrease, but the information group had an estimate of greater reduction than the preparation kit group.

Even so, only the preparatory program with the use of explanatory video obtained enough impact to differentiate it from the control group. This result agrees with a study of Melamed and Siegel (1975)) and in part with the study of Fincher *et al*. (2011), which did not find significantly statistical differences between Australian children aged three to 12 years who received standard hospital information on the surgical procedure without preoperative education (control group), and those who received a preoperative intervention through photographs, a demonstration of the use of surgical instruments by means of a model, and a walk through the surgical center between five and ten days before the operation. This result indicates the importance of a distraction factor in psychological preparation, which was not considered in the study by Fincher *et al*. (2011). Perhaps only the information given through the explanatory video has obtained entertainment value for the age group of the children in the research, because the doll may have been considered by the children as something childish. The literature, however, is not sufficiently consistent about the advantages and disadvantages of the different preparation strategies, since the other techniques used are described as effective in the preparation of children (Broering & Crepaldi, 2011; Cuzzocrea *et al.*, 2013; Fernandes *et al*., 2014b, 2015).

The third hypothesis (H3), that girls had higher initial levels of stress and anxiety and would benefit the most from preparations, was rejected. Although, on average, girls had higher levels of stress and anxiety, their scores were not significantly higher than those of boys. In almost every group, especially in the preparation with video group, results suggest that the boys group benefited the most from psychological preparation for both outcomes.

This result is in agreement with literature findings (Fernandes *et al*., 2014b; Melamed & Siegel, 1975). However, Fernandes *et al*. (2014a) state that male children manifest more positive attitudes, reporting less avoidance and less painful evaluation of medical procedures. A possible explanatory factor may be the social reinforcement of the belief that women are more emotive and less pain-tolerant, and that men are educated at an early age to adopt active strategies to suppress verbalization and external manifestation of pain. Thus, boys are expected to report more positive attitudes towards health care, as well as lower levels of perceived pain in relation to medical and everyday procedures when compared to girls. Based on these data, it is possible to assume that boys were more favored by the explanatory video due to society's tendency to encourage greater pain tolerance in boys.

In this research, the video group used a cartoon in which the main character was a boy, which may have influenced male participants to feel more identified with the movie because of their gender. Moreover, in a study conducted by Broering and França (2008), it was found that boys showed more imitation behaviors when compared to girls. In this way, boys may have benefited more from the preparation with video through modeling, by imitating the behaviors seen in the video during the pre-surgical period.

In an ideal context, pre-surgical psychological preparation should consider the particularities of each child, their health condition, experience, family and socio-cultural insertion, as well as their familiarity with the environment, staff and hospital procedures, considering that each child is unique and can make use of their strategies of coping with the situation imposed upon them (Jaaniste *et al*., 2007; Lambert *et al*., 2013; Yuki & Daaboul, 2011). It is relevant, however, that hospitals consider the results of research regarding interventions in preoperative child anxiety and stress, as well as their reality in terms of available physical staff resources, in choosing how to best mitigate these psychological reactions and make the hospital environment less hostile to the child (Aouad, 2011; Fincher et al. 2011).

The findings of this research indicate that the use of an explanatory video presented by a Psychology professional is a cost-effective alternative to attenuate stress and anxiety in the short term. Such intervention is significantly faster

(around five minutes) than verbal interventions or through a pre-surgical preparation kit (approximately 30 minutes). It is recommended that further studies use a cartoon with a female character be used for girls, considering that boys were more favored, especially those with higher initial stress levels.

Moreover, it is important to emphasize the mediating role of the Psychology professional in the application of the intervention. Very often, despite the existence of therapeutic materials aimed at the pre-surgical psychological preparation of children, they are underused by medical teams, and limited to distractive purposes only (Lambert *et al*., 2013). A psychologist, making use of such materials, is able to translate technical information about surgical procedures for the child and their family with accessible language and an attitude that encourages patients to express their doubts.

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