

**How to Cite:**

Tork, H. M., & Elmwafie, S. M. (2022). Effect of self-driving of pediatric patients undergoing elective surgery to the operating room in reducing preoperative anxiety and pain and boost parental satisfaction. *International Journal of Health Sciences*, 6(S8), 4794–4809. <https://doi.org/10.53730/ijhs.v6nS8.13304>

## **Effect of self-driving of pediatric patients undergoing elective surgery to the operating room in reducing preoperative anxiety and pain and boost parental satisfaction**

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**Abstract**---Background: Preoperative anxiety in children is highly prevalent, associated with negative outcomes, and has the potential to alter the dynamics of a surgical operation. If preoperative anxiety is mismanaged, it can result in postponed or canceled essential procedures. Objective: The study aimed to investigate whether self-driving of children to an operating room could relieve their preoperative anxiety and pain, in addition to assessing parental satisfaction. Methods: A prospective, two-armed quasi-experimental study was designed with three measurement time points, including 60 children (4–10 years) from both genders who had undergone elective surgeries and who were randomly allocated to the study group (n = 30) and control group (n = 30). Both groups received standard information provided by the nursing staff, and the study group only used self-driving to the operating room. The primary outcome was change in the children preoperative anxiety levels, as measured by the modified Yale Preoperative Anxiety Scale (m-YPAS) and the measurement of the physiological variables both in ward and when the children approached the anesthesia room. Pain was assessed by the Faces Pain Scale-Revised (FPS-R). A secondary outcome was parent satisfaction. Results: The study and control groups were homogeneous with regard to age (P-value = .498) and gender (P-value = .292). No significant difference in anxiety level was observed between the study and control groups at the baseline (T1) (P-value = .057). Differences were detected between both groups during intervention—while the children drove themselves to the OR (T2) and in the pre-surgical area (T3)—and these differences were statistically significant

(Pvalue = .000). The mean parental satisfaction score of the study group was higher than the mean scores of the control group and the difference was statistically significant. Conclusion: Children's self-driving to the operating room was effective in reducing preoperative anxiety in children aged 4 to 10 years and could potentially be offered to most children as a low-cost, easy to implement, and effective approach to relieving anxiety in the preoperative area.

**Keywords**---anxiety, children self-driving, distraction techniques, parental satisfaction.

## Introduction

Anxiety in children undergoing surgery is defined as subjective sensations of tension, unease, and worry, which can manifest itself in a variety of ways. When the child is scheduled for surgery, both the child and his parent endure at least some angst. The focus here is on the children's experience specifically; a child's anxiety about surgery can lead to a variety of adverse clinical, psychological, and behavioral outcomes. It is linked to bad dreams, sleep disturbances, disobedience, and negative emotional disturbance, including lack of cooperation with health care providers in the perianesthesia settings (Zhu et al., 2015; Cheryl et al., 2019). In addition to anxiety and subsequent expressions, children frequently suffer from postoperative pain (Stewart, 2016).

Preoperative children's anxiety is responsible for negative impacts on anesthesia management, requiring large doses of induction and maintenance anesthetics, prolonging time of induction, delaying the recovery, and causing postoperative delirium as well as a greater level of postoperative anxiety, which negatively affects patient satisfaction with postsurgical analgesia (Tomaszek et al., 2019). Higher levels of postoperative pain intensity is also associated with preoperative children's anxiety; these children require higher doses of pain medications after surgery compared to children with low levels of preoperative anxiety (Getahun et al., 2020; Cheryl et al., 2020). Pediatric surgery can also be stressful to parents, and parental anxiety is believed to increase children's anxiety (Yun et al., 2015; Fincher et al, 2012).

The prevalence of pediatric chronic postsurgical pain (CPSP) has been estimated to be between 11 to 38%, with different pain trajectories depicted by graphical representations of a patient's pain scores over observation (Batoz et al., 2016; Rosenbloom et al., 2019; Kannampallil et al., 2016). There is growing evidence that psychological factors such as pediatric perioperative anxiety and parental pain anxiety have a massive impact in the development of CPSP in children, but more research is needed to fully comprehend the role of perioperative anxiety and related states in predicting pediatric postsurgical pain (Rabbitts et al., 2017; Williams et al., 2017; Perry et al., 2018). A limited body of literature has examined the relationship between parents' satisfaction with the quality of pediatric health care and pain or anxiety management intervention in a pediatric surgical department (Mathias et al., 2021). Thus, by identifying the research gap in the area, the present study aimed to examine the parent satisfaction level with using

interventions to reduce pain and anxiety. All the aforementioned consequences could have cost implications for parents and institutions, which also affect the surgical outcome. Book and colleagues, reported that children and their parents need to be informed about the surgical procedure, anesthesia, potential pain concerns, and other procedures they might have during their hospital stay. Patients' perceptions of the quality of the services provided frequently lead to patient satisfaction (Book et al., 2020). Consequently, patient satisfaction is a key indicator of health-care quality in most countries. As a result, programs to create and improve satisfaction must be developed. However, the importance of satisfaction is increased when it can be promoted by reducing the anxiety of both; child and parent (Ghabeli et al., 2014).

Various non- pharmacological interventions have shown that providing relevant patient information and proper distraction techniques before surgical operation can lower preoperative anxiety in children(Dai & Livesley, 2018; Fernandes et al., 2014). To reduce children's preoperative anxiety and improve children's cooperation during the induction of anesthesia, pediatric staff have implemented a variety of distraction strategies. In hospitals, several distraction techniques are used to reduce children's anxiety prior to anesthesia induction; these techniques can also be used during parental separation(Härter et al., 2021; Sjöberg et al., 2015).

In San Diego, the Rady Children's Hospital has unveiled a program that uses remotecontrol luxury mini cars that allow children to "drive" themselves to the operating room. The cars at the Rady Children's Hospital are actually operated by a nurse or a doctor, and are part of a new program designed to make children more relaxed and relieve their anxiety before their procedures. Dr. Daniela Carvalho, medical director of surgical services at the hospital, reported that "With this program, the children are having fun and their parents are seeing that they're relaxed and happy" (Thomson, 2017).

### **Significance of the study**

Hospitalization and surgery can be traumatic experiences for children, and approximately 50% report high levels of anxiety. Preoperative anxiety has been linked to negative post-operative outcomes such as emotional disturbance, cognitive inefficiency, behavioral impairments, sleep disturbances, bad dreams and disobedience (Banchs and Lerman, 2014). As a result, reducing preoperative anxiety is a critical goal for pediatric staff. Therefore, the aim of the present study is to investigate whether the self-driving of children to an operating room can relieve preoperative children's anxiety.

### **Aim of the study**

The aims of the research were first to investigate whether the self-driving of children to an operating room could relieve their preoperative anxiety and pain, and second to assess parental satisfaction.

## **Research hypotheses**

**H1:** Preoperative children's anxiety decreases after the implementation of children's self-driving to the operating room as a distraction technique.

**H2:** Preoperative children's pain decreases after implementing children's self-driving to the operating room.

**H3:** Parental satisfaction increases after the implementation of children's self-driving to the operating room.

## **Operational definition**

Self-driving of children: the process in which children using Age-appropriate car with safety measures and driving themselves to certain place. This process is a part of a new program designed in San Diego children's hospital for children undergoing elective surgery to make children more relaxed before their procedures.

## **Subjects and Methods**

### **Research design**

This study is quasi-experimental and focused on the evaluation of the effectiveness of children's self-driving in reducing preoperative anxiety over a 3-month period.

### **Study Setting**

The study was conducted at the Children's Specialized Hospital, Nasr City, Cairo, Egypt. Parents present at their children's bedside were approached if the child met all inclusion criteria. The reason given for selecting the above mentioned setting, because flow rate of children undergoing elective surgery was high and it provide cover a wide range of children with different socio-demographic characteristics.

### **Study sample**

A purposive sample of total of 60 children were recruited who met the inclusion criteria and all children were divided into the study group and control group using a random number table. The study was conducted between June and August 2021.

### **Inclusion criteria**

1. Child was hospitalized in one of the two designated wards during the afternoon shift (2 PM to 8 PM).
2. Child aged from 4–10 years old and undergoing elective surgery i.e., dental, eye, or Ear-Nose- Throat (ENT) surgery, requiring general anesthesia.
3. Parental and child approval to participate in the study.

### **Exclusion criteria**

1. Children under the age of four or above 10 years were excluded because they are not appropriate for self-driving intervention.
2. Children with chronic illness, developmental retardation, mental disorder, epilepsy, or visual impairment.
3. Child required emergency surgery or presence of routine surgical disease.

Power analysis: Normal approximation using the Z statistic

$$A = (1/q_1 + 1/q_0) = 4.0000$$

$$B = (Z_\alpha + Z_\beta)^2 = 3.8415$$

Total group size =  $N = AB/(E/S)^2 = 59.029$

With 1.96 Standard deviation of the outcome in the population

Study group equal 30 and Control group equal 30 with a 95% level of confidence ( $\beta$  error = 5%), and a study power of 80% ( $\beta$  error=20%).

### **Data collection tools 1) Demographic data and physiological assessment**

This tool consists of two parts: part (1) concerns the demographic data, which include child initials, age, gender, diagnosis, type of surgery and, finally, information regarding use of analgesics. These data were extracted from the medical records. Part (2) is the physiological assessment, including heart rate, respiratory rate, and blood pressure.

### **Modified Yale Preoperative Anxiety Scale**

Several scales have been developed to measure Pediatric Preoperative Anxiety (PPOA) and have been used for both clinical and research purposes. The Yale Preoperative Anxiety Scale (YPAS) was developed by Kain et al. (1995) and has been used in over 100 studies across a variety of health fields (Remo et al., 2016). It was subsequently revised by Kain et al., (1997) to create the modified Yale Preoperative Anxiety (mYPAS), which is a commonly used validated observational tool for children's anxiety. The m-YPAS consists of 27 items divided into five domains of behavior: activity, emotional expression, state of arousal, vocalization, and use of parents. In this instrument, each domain is attributed a score between 1 to 4, except for the vocalization domain, which is rated on a 1–6 scoring system, with higher scores indicating a high level of anxiety. The m-YPAS has high inter-rater reliability; with agreement between observers ranging from 0.68 to 0.86 and intra-observer weighted K agreement ranging from 0.63 to 0.90 (Kain et al., (1997).

### **Faces Pain Scale-revised**

Children's pain was assessed using the Faces Pain Scale Revised (FPS-R), developed by Hick et al. (2001) This scale comprises six child faces, ranging from a happy face to a grimace on both the front and back sides. The child points to a number from 0–10 to indicate the degree of pain that he/she is experiencing. Higher scores indicate greater pain. Pain assessment was conducted when the

child expressed a willingness to cooperate. In this study, Cronbach's alpha was 0.82. The validity of the FPS-R was supported by positive correlations with the Visual Analogue Scale ( $r = .92$ ,  $N = 45$ ) of Hick et al. (2001).

### **Parent satisfaction questionnaire Short Form**

The parent satisfaction questionnaire (PSQ) contains 18 items used to assess parent satisfaction with the care provided. This questionnaire involves the parent's (or patient's) feedback on the care received. It is divided into seven subscales. Satisfaction with care is scored by a 5-level ordinal scale (1 = strongly agree to 5 = strongly disagree). High scores indicate satisfaction with received care. (Marshall & Hays, 1994).

### **Data collection procedure**

An official letter was submitted from the faculty of nursing, Zagazig University to the director of Children's Specialized Hospital, Nasr City and it was attached with objective, hypotheses and methodology of the study. Once permission was granted to proceed with the study, eligible participants and their parents were informed about the study objective and related information. Participation was voluntary, and all data were anonymized. The parents were asked to provide written informed consent, and children gave their permission orally. After informed consent was provided, children were randomly allocated to the intervention group ( $n=30$ ) or control group ( $n=30$ ). Assessments were carried out at the following time points: (1) T1, in the children's rooms at the surgical ward, before possible intervention; (2) T2, during the children's journeys to the OR (while they drove themselves); (3) T3, in the pre-surgical area, where the children received their anesthesia. The primary outcome was change in the children preoperative anxiety levels, as measured by the modified Yale Preoperative Anxiety Scale (m-YPAS) and the measurement of the physiological variables both in ward and when the children approached the anesthesia room. Pain was assessed by the Faces Pain Scale-Revised (FPS-R). A secondary outcome was parent satisfaction.

### **A pilot study**

The pilot study was conducted on 10% of the children (6 children) to ensure the clarity and test the feasibility of the research process; required modifications were subsequently carried out. Children included in the pilot study were involved in the current study.

### **Ethical considerations**

The study received the approval of the pertinent Ethics Committee. Permission was obtained from the head of the surgery and intensive care unit at the hospital. The participating parents and their children received oral and written information about the study's aim and structure when visiting the surgical unit. Participation was voluntary and the participants were informed that they had the right to withdraw at any time without explanation.

## Statistical analysis

Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Statistical analysis was used to analyze data using SPSS version 21 (SPSS Inc., Chicago, IL, USA). The Shapiro–Wilk and Kolmogorov–Smirnov tests were used to determine whether or not a variable follows a normal distribution; when the normal distribution of the data could not be assumed, the non-parametric Wilcoxon W Test and Spearman correlation coefficient were used instead. Qualitative variables were compared using the chi-square test whenever the expected value in one or more of the cells was larger than 2x2 cross-tables, and the Monte Carlo (MC) test was applied whenever the expected value in two or more of the cells was less than 5. Statistical significance was considered at  $p$ -value  $<0.05$ .

## Results

Table (1) shows the personal characteristics of the control and study children. Regarding age; it shows that (50% and 43.3%) of control and study children were less than 6 years with a mean age of ( $6.83\pm 2.214$  and  $6.63\pm 2.059$ ) respectively. Regarding gender (53.3% and 66.7%) of the control and study children were male; in addition, (33.3% and 83.3%) of their surgeries were an ENT procedure and (63.3% and 100%) had their surgery without analgesics, with statistically significant differences between the two groups ( $p$ -value  $<0.05$ ). With regards to mother's level of education for the control and study groups, no significance differences were detected. Moreover, comparing the study group to the control group regarding overall parental satisfaction, the scale showed significant differences. In terms of satisfaction, parents in the study group had higher mean scores than parents in the control group ( $P<0.05$ ).

Figure (3) shows the heart rate of control and study children, revealing that 76.7% and 83.3% respectively had a normal heart rate, while 23.3% and 16.7% had an abnormal heart rate. Regarding the blood pressure of control and study children, the same figure reveals that 63.3% and 70% respectively had normal blood pressure, whereas 36.7% and 30% had abnormal blood pressure. Table (2) presents the level of anxiety between the control and study children. Regarding T1, the means of activity and emotional expression for the control and study groups respectively were ( $55.42\pm 23.06$  and  $59.17\pm 24.11$ ), the means of vocalization were ( $44.44\pm 21.41$  and  $47.78\pm 19.93$ ), the means of state of arousal were ( $49.17\pm 23.00$  and  $52.50\pm 20.08$ ), the means of use of parents were ( $50.42\pm 24.57$  and  $57.50\pm 24.70$ ), and the total anxiety means were ( $46.72\pm 18.23$  and  $55.22\pm 18.24$ ), with statistically insignificant differences between the two groups ( $p$ -value  $> 0.05$ ). Regarding T2, there was a significant decrease of anxiety level among the study group compared to the control group. The means of activity and emotional expression for the control and study group respectively were ( $71.67\pm 18.26$  and  $26.67\pm 6.34$ ,  $76.67\pm 17.29$  and  $32.50\pm 11.65$ ), the means of vocalization were ( $62.78\pm 18.41$  and  $27.22\pm 11.97$ ), the means of state of arousal were ( $64.17\pm 20.43$  and  $30.83\pm 10.75$ ), the means of use of parents were ( $69.17\pm 15.65$  and  $30.00\pm 13.77$ ), and the total anxiety means were ( $68.89\pm 11.80$  and  $29.44\pm 5.61$ ), with highly statistically significant differences between the two

groups ( $p$ -value  $> .000$ ). Regarding T3, there was a significant decrease of anxiety level among the study group compared to the control group. The means of activity and emotional expression between the control and study groups were respectively ( $85.83 \pm 25.16$  and  $40.83 \pm 17.96$ ,  $95.83 \pm 9.48$  and  $40.83 \pm 15.37$ ), the means for vocalization were ( $84.44 \pm 26.96$  and  $34.44 \pm 13.08$ ), the means for state of arousal were ( $88.33 \pm 22.49$  and  $35.00 \pm 14.08$ ), the means for use of parents were ( $95.83 \pm 11.53$  and  $41.67 \pm 15.16$ ), and the means for total anxiety were ( $90.06 \pm 13.99$  and  $38.56 \pm 10.13$ ), with highly statistically significant differences between the two groups ( $p$ -value  $> 0.001$ ).

Table (3) shows the level of pain between the control and study children. Regarding T1; the means for pain level between the control and study groups respectively were ( $1.93 \pm 0.98$  and  $1.80 \pm 0.99$ ), with statistically insignificant differences between the two groups ( $p$  value  $> 0.05$ ). Regarding T2; there was a significant decrease of pain level among the study group compared to the control group whereas the pain levels between the control and study groups were ( $2.40 \pm 0.62$  and  $1.13 \pm 0.35$ ), with highly statistically significant differences between the two groups ( $p$ -value  $> 0.001$ ). Regarding T3, there was a significant decrease of pain level among the study group compared to the control group whereby the means of pain level were respectively ( $3.10 \pm 1.35$  and  $1.20 \pm 0.41$ ), with highly statistically significant differences between the two groups ( $p$ -value  $> 0.001$ ).

Table (4) illustrates the correlation between personal characteristics, heart rate, blood pressure, and anxiety among the control and study groups. Older age children had a high level of anxiety during T1 among the control group, and female children had a higher level of anxiety during T2 among both the study and control groups. In addition, children on analgesics in the control group had a low level of anxiety during T1 and T2. In the control group, blood pressure increased whenever level of anxiety increased during T1 and T2.

Table (5) highlights the correlation among personal characteristics, heart rate, blood pressure, and pain level between the control and study groups. Older age children had a high level of pain during T1, and younger children had a high level of pain during T3 in the control group; in the study group, older age children had a high level of pain during T2 and T3. Furthermore, children on analgesics in the control group had a low level of pain during T1 and a high level of pain during T3; in addition, blood pressure and heart rate increased whenever level of pain increased during T1 and T3 for children in the control group.

Table (6) shows the correlation among level of anxiety and pain level between the control and study groups. In the control group, an increase in level of anxiety led to a high level of pain during T1 and an increase level of anxiety lead to low level of pain during T3, whereas in the study group an increase in level of anxiety led to a high level of pain during T1, T2, and T3. In addition, in the control group an increase in level of anxiety during T3 led to a high level of pain during T3 and in the study group, an increase in level of anxiety during T3 led to a high level of pain during T2.

## Discussion

The study aimed to investigate whether the self driving of children undergoing elective surgery to the operating room could relieve their preoperative anxiety and pain compared with the standard information procedure. In the literature, several studies show the effectiveness of other non-pharmacologic approaches for reducing preoperative anxiety and pain that are provided by nurses or trained researchers, such as tablet interventions and virtual reality (Litman, 2016; Marechal et al., 2017; Seiden et al., 2014), video clips (Mifflin et al., 2012), and storytelling and coloring (Al-Yateen et al., 2016). To our knowledge, this study represents the first time that children's self-driving has been used to relieve children's anxiety levels before elective surgery. In this study, the characteristics of children and the mean anxiety score in the two groups before the intervention were not significant, which could affect children's anxiety levels. As a result, the participants were homogeneous with regards to age, gender, and mother's educational level. The present study is similar to several studies that have used the m-YPAS as the gold standard for the measurement of observer-rated child anxiety (Rostami et al., 2022, Goldschmidt & Woolley, 2017; Lian-Gao et al., 2014). Among the methods for reducing children's preoperative anxiety, self-driving is a safe, understandable, and appealing method that nurses can easily implement. In addition, it is considered a simple, low cost, and effective method. This study shows that in a sample of Egyptian children, the mean of anxiety in the intervention group after selfdriving to an operating room was reduced compared to the mean of the initial anxiety, whereas in the control group, there was a significant increase. The findings show that in the control group, after receiving routine care, the mean anxiety scores increased significantly compared to baseline; this finding is consistent with the result of previous studies (Rostami et al., 2022; Kim et al., 2015; Lee et al., 2013).

The current study concurs with the study of Ryu et al. in its finding that no significant difference of anxiety levels were measured with the m-YPAS among control and study groups at baseline (T1). At the holding area, both studies indicated that there are statistically significant differences in anxiety levels between control and study groups (T2). Unfortunately, it is not possible to make the same comparison regarding anxiety levels during pre-surgical area (T3) as Ryu et al. did not use the m-YPAS during this stage (Ryu et al., 2017; Ryu et al., 2018). Moreover, the present study reveals that the parents of the study group were more satisfied than the parents of the control group after the intervention; this finding aligns with the findings of other studies which have found that pain intervention leads to higher parental satisfaction (Mathias et al., 2021). This study was limited by the fact that it did not examine the effect of self-driving without parental presence. The study's goal, however, was to see if the child's selfdriving to the operating room could reduce preoperative anxiety without requiring any changes to the hospital's standard care. However, the objective of the study was to test whether the child's self-driving to operating room could relieve preoperative anxiety without needing to modify the standard care used in the hospital. The second limitation is that the study involves children undergoing elective surgery (more specifically, dental, eye, and ENT surgery). Therefore, the results of this study might not be generalizable to other types of surgeries. The third limitation is that the study excluded children under the age of four years of

age on the premise that they would be unable to drive the car. As a result, the findings are only applicable to children aged four years and up. Children aged one to less than four years may require different distraction techniques.

## Conclusion and Recommendations

Overall, the results of the present study show that children's self-driving to the operating room was effective in reducing preoperative anxiety and pain in children aged 4 to 10 years as well as in increasing parent satisfaction. This intervention does not require special facilities and it can be offered to most children as a low-cost, simple to implement, and effective approach to relieving anxiety in the preoperative area. Therefore, the authors suggest using children's self-driving in the preoperative area prior to elective surgery to reduce anxiety and pain in children and also to improve surgical outcomes. In addition, it has high acceptance by children and parents.

## Acknowledgments

The authors would like to express their gratitude to all children and their parents who participated in the study. A special thanks to the nursing staff in the departments of surgery, public hospital, Egypt. Many thanks to Dr. Thomas Alan for reviewing the manuscript and our sincere gratitude to all who have directly or indirectly helped in the completion of this study.

Figure 1: Children drive themselves to operating room



Figure 2: The flow chart of the research design with outcomes, tools, and informants at each time point

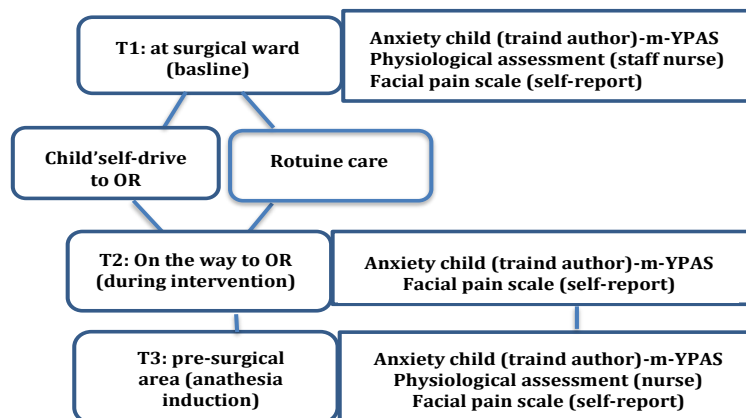


Table 1: Personal characteristics of study and control groups and parental satisfaction

Parameter	Control group		Study group		Statistical test	
	N (30)	%	N (30)	%		P-value
<i>Age</i>						
<6 years	15	50.0	13	43.3	1.393	.498
6-8 years	6	20.0	10	33.3		
>8 years	9	30.0	7	23.3		
Mean and SD	6.83±2.214		6.63±2.059			
<i>Gender</i>						
Male	16	53.3	20	66.7	1.111	.292
Female	14	46.7	10	33.3		
<i>Type of surgery</i>						
Adenoidectomy	0	0	1	3.3	MC	.000**
Tonsillectomy	10	33.3	3	10.0		
Dental surgery	9	30.0	1	3.3		
Eye surgery	1	3.3	0	0		
Other ENT procedures	10	33.3	25	83.3		
<i>On analgesics</i>						
Yes	11	36.7	0	0	13.469	.000**
No	19	63.3	30	100		
<i>Mother's level of education</i>						
<i>n(%)</i>						
Primary school	1(3.3)		1(3.3)			.812
Diploma	8 (26.7)		6 (20.1)			
University	21(70)		23 (76.6)			
<i>Parental satisfaction (Mean and SD)</i>						
Overall satisfaction scale	61.71 (1.44)		66.83 (1.23)		t = 3.22, p < 0.011	
General satisfaction	7.53 (0.21)		8.30 (0.21)		t = 1.91, p = 0.069	

Figure 3: Percentage distribution of study and control groups according to their Heart Rate and Blood pressure

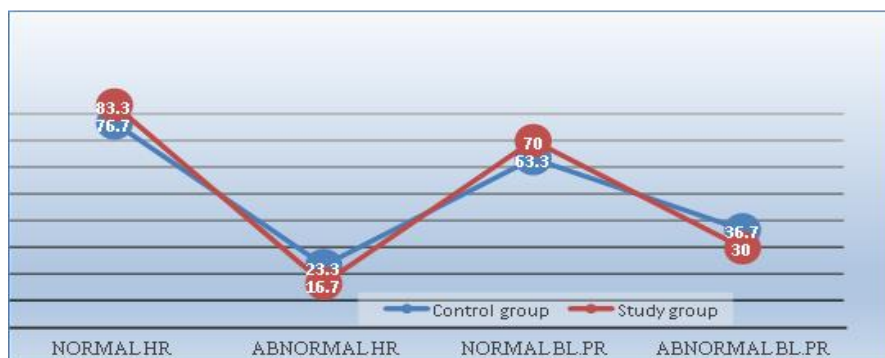


Table 2: Mean and standard deviation distribution of anxiety level for study and control groups according to their m-YPAS scores

Parameter	T1		Mann-Whitney U Z (P-value)
	Control	Study	
	$\bar{x} \pm SD$	$\bar{x} \pm SD$	
Pain T1*	1.93±0.98	1.80±0.99	-.665 (.506)
Pain T2*	2.40±0.62	1.13±0.35	-6.190 (.000)**
Pain T3*	3.10±1.35	1.20±0.41	-5.448

(.000)\*\*

T1: the baseline assessment at surgical ward, T2: while the children drove to OR  
T3: the 3rd assessment at the pre-surgical area

Table 3: Mean and standard deviation distribution of study and control groups according to their level of Pain

Parameter	*T1		Mann-Whitney U Z (P-value)	*T2		Mann-Whitney U Z (P-value)	*T3		Mann-Whitney U Z (P-value)
	Control	Study		Control	Study		Control	Study	
	$\bar{x} \pm SD$	$\bar{x} \pm SD$		$\bar{x} \pm SD$	$\bar{x} \pm SD$		$\bar{x} \pm SD$	$\bar{x} \pm SD$	
Activity	55.42±23.06	59.17±24.11	-1.248 (.212)	71.67±18.26	26.67±6.34	-6.805 (.000)**	85.83±25.16	40.83±17.96	-5.486 (.000)**
Vocalization	44.44±21.41	47.78±19.93	-1.457 (.145)	62.78±18.41	27.22±11.97	-6.177 (.000)**	84.44±26.96	34.44±13.08	-5.513 (.000)**
Emotional	59.17±20.22	55.42±21.63	-1.743 (.081)	76.67±17.29	32.50±11.65	-6.519 (.000)**	95.83±9.48	40.83±15.37	-6.933 (.000)**
State of arousal	49.17±23.00	52.50±20.08	-1.405 (.160)	64.17±20.43	30.83±10.75	-5.655 (.000)**	88.33±22.49	35.00±14.08	-6.157 (.000)**
Use of parent	50.42±24.57	57.50±24.70	-2.344 (.019)*	69.17±15.65	30.00±13.77	-6.263 (.000)**	95.83±11.53	41.67±15.16	-6.858 (.000)**
Total anxiety	46.72±18.23	55.22±18.24	-1.903 (.057)	68.89±11.80	29.44±5.61	-6.662 (.000)**	90.06±13.99	38.56±10.13	-6.721 (.000)**

T1: the baseline assessment at surgical ward, T2: while the children drove to OR  
T3: the 3rd assessment at the pre-surgical area

Table 4: Correlation among personal characteristics, heart rate, blood pressure and anxiety (control and study groups)

Parameter		Control			Study		
		Pain_T1	Pain_T2	Pain_T3	Pain_T1	Pain_T2	Pain_T3
Anxiety T1	r	.595**	-.032	-.373*	.777**	.405*	.458*
	P value	.001	.869	.042	.000	.026	.011
Anxiety T2	r	.167	-.036	-.357	-.257	.128	.000
	P value	.378	.849	.053	.170	.499	1.000
Anxiety T3	r	-.181	.109	.361*	.033	.369*	.254
	P	.338	.566	.050	.862	.045	.176

Table 5: Correlation among personal characteristics, heart rate, blood pressure and pain (control and study groups)

Parameter		Control			Study		
		Pain_T1	Pain_T2	Pain_T3	Pain_T1	Pain_T2	Pain_T3
Age	r	.395*	.075	-.826**	.299	.459*	.543**
	P value	.031	.692	.000	.108	.011	.002
Gender	r	-.094	-.121	-.158	.144	.347	.177
	P value	.620	.524	.405	.447	.061	.350
Diagnosis	r	-.102	-.157	.492**	.078	.150	.000
	P value	.591	.407	.006	.681	.428	1.000
Surgery type	r	.332	.169	.089	-.356	.171	-.218
	P value	.073	.372	.642	.054	.367	.247
On analgesics	r	-.518**	-.036	.666**	--	--	--
	P value	.003	.851	.000	--.	--.	--.
HR	r	-.174	-.224	.433*	.183	-.175	.000
	P value	.357	.233	.017	.334	.354	1.000
BP	r	.421*	.036	-.781**	-.089	-.043	.218
	P value	.021	.851	.000	.640	.822	.247

Table 6: Correlation among anxiety and pain (control and study groups)

Parameter		Control			Study		
		tot.anexi. T1	tot.anexi. T2	tot.anexi. T3	tot.anexi. T1	tot.anexi.T 2	tot.anexi. T3
Age	r	.409*	.269	-.267	.011	-.138	-.029
	P value	.025	.151	.153	.952	.468	.879
Gender	r	.139	.500**	.192	.208	.370*	.245
	P value	.462	.005	.309	.270	.044	.193
Diagnosis	r	-.138	-.384*	-.057	.112	-.305	-.120
	P value	.467	.036	.766	.557	.101	.528
Surgery type	r	.240	-.090	-.255	-.375*	.351	.160
	P value	.202	.635	.174	.041	.057	.397
On analgesics	r	-.425*	-.619**	.031	--	--	--
	P value	.019	.000	.871	--	--	--
HR	r	.169	-.345	.156	.235	.072	-.070
	P value	.372	.062	.410	.210	.705	.714
BP	r	.481**	.493**	-.217	-.143	.022	-.258
	P value	.007	.006	.250	.450	.908	.169

## References

Al-Yateen N, Brenner M, Shorrab AA, Docherty C (2016) Play distraction versus pharmacological treatment to reduce anxiety levels in children undergoing day surgery: a randomized controlled non-inferiority trial. *Child Care Health Dev* 42(4):572–581. [https:// doi.org/10.1111/cch.1234 3](https://doi.org/10.1111/cch.12343).

- Banchs, rj. and Lerman, J. (2014). Preoperative Anxiety Management, Emergence Delirium, and Postoperative Behavior. *Anesthesiology clinics*. 32(1), PP. 1-23.
- Batoz H, Semjen F, Bordes-Demolis M, Bénard A, Nouette-Gaulain K. (2016). Chronic postsurgical pain in children: prevalence and risk factors. A prospective observational study. *Br J Anaesth*. 117:489–96. doi:10.1093/bja/aew260.
- Book F, Goedeke J, Poplawski A, Muensterer OJ. (2020). Access to an online video enhances the consent process, increases knowledge, and decreases anxiety of caregivers with children scheduled for inguinal hernia repair: a randomized controlled study. *J Pediatr Surg*. 55:18–28. doi: 10.1016/j.jpedsurg.2019.09.047.
- Buckley N., and Schmidt L. A. (2019). Association of Temperament With Preoperative Anxiety in Pediatric Patients Undergoing Surgery: A Systematic Review and Metaanalysis. *JAMA Netw Open*. Jun; 2(6), doi: 10.1001/jamanetworkopen. 2019.5614.
- Cheryl H. T. Chow , Louis A. Schmidt & D. Norman Buckley (2020) The role of anxiety and related states in pediatric postsurgical pain, *Canadian Journal of Pain*, 4:4, 26-36, DOI: 10.1080/24740527.2020.184760.
- Cheryl H. T. Chow, Rizwan A., Richard Xu, Poulin L., Bhardwaj V., Van Lieshout R.,
- Dai Y, Livesley J. (2018). A mixed-method systematic review of the effectiveness and acceptability of preoperative psychological preparation programmes to reduce paediatric preoperative anxiety in elective surgery. *J Adv Nurs*. doi: 10.1111/jan.13713. [Epub ahead of print].
- Fernandes SC, Arriaga P, Esteves F. (2014). Providing preoperative information for children undergoing surgery: a randomized study testing different types of educational material to reduce children's preoperative worries. *Health Educ Res*. 29:1058–76. doi: 10.1093/her/cyu066.
- Fincher, W., Shaw, J., & Ramelet, A. S. (2012). The effectiveness of a standardised preoperative preparation in reducing child and parent anxiety: A single-blind randomised controlled trial. *Journal of Clinical Nursing*, 21, 946–955.
- Getahun AB, Endalew NS, Mersha AT, Admass BA. (2020). Magnitude and Factors Associated with Preoperative Anxiety Among Pediatric Patients: Cross-Sectional Study. *Pediatric Health Med Ther*. Dec 16;11:485-494. doi: 10.2147/PHMT.S288077. PMID: 33364873; PMCID: PMC7751437.
- Ghabeli, F., Moheb , N., Nasab, S.D. (2014). Effect of Toys and Preoperative Visit on Reducing Children's Anxiety and their Parents before Surgery and Satisfaction with the Treatment Process. *Journal of Caring Sciences*, 3(1), 21-28.
- Goldschmidt K, Woolley A. (2017). Using Technology to Reduce Childrens' Anxiety Throughout the Perioperative Period. *J Pediatr Nurs*. Sep-Oct;36:256-258. doi: 10.1016/j.pedn.2017.04.006. Epub 2017 Apr 28. PMID: 28457695.
- Härter, V., Barkmann, C., Wiessner, C., Rupprecht M, Reinshagen K and Trah J (2021). Effects of Educational Video on Pre-operative Anxiety in Children - A Randomized Controlled Trial. *Front. Pediatr*. 9:640236. doi: 10.3389/fped.2021.640236.
- He HG, Zhu L., Chan SWC, Liam, JLW, Li HCW, Ko SS & Wang, W. (2015). Therapeutic play intervention on children's perioperative anxiety, negative emotional manifestation and postoperative pain: a randomized controlled trial. *Journal of Advanced Nursing* 71, 1032–1043.

- Hicks CL, von Baeyer CL, Spafford PA, van Korlaar I, Goodenough B. (2001). The Faces Pain Scale-Revised: toward a common metric in pediatric pain measurement. *Pain*. Aug;93(2):173-183. doi: 10.1016/S0304-3959(01)00314-1. PMID: 11427329.
- Kain Z, Mayes L, Cicchetti D, et al. (1995). A measurement tool for pre-operative anxiety in children: the Yale preoperative anxiety scale. *Child Neuropsychol*1:203-10.
- Kain ZN, Mayes LC, Cicchetti DV, Bagnall AL, Finley JD & Hofstadter MB (1997). The Yale Preoperative Anxiety Scale: how does it compare with a 'gold standard'? *Anesthesia and Analgesia* 85, 783-788.
- Kannampallil T, Galanter WL, Falck S, Gaunt MJ, Gibbons RD, McNutt R, Odwazny R, Schiff G, Vaida AJ, Wilkie DJ, et al. (2016). Characterizing the pain score trajectories of hospitalized adult medical and surgical patients: a retrospective cohort study. *Pain*.157 (12):2739-46. doi:10.1097/j.pain.0000000000000693.
- Kim H, Jung SM, Yu H, Park SJ. (2015). Video distraction and parental presence for the management of preoperative anxiety and postoperative behavioral disturbance in children: A randomized controlled trial. *Anesth Analg*.121: 778-84.
- Lee JH, Jung HK, Lee GG, Kim HY, Park SG, Woo SC. (2013). Effect of behavioral intervention using smartphone application for preoperative anxiety in pediatric patients. *Korean J Anesthesiol*. 65:508.
- Lian-Gao X., Liu Y., Shi Tian S., Qing Zhang D., Ping Wu Q. (2014). Effect of interesting games on relief of preoperative anxiety in preschool children. *International Journal of Nursing Sciences*, Volume 1, March Pages 89-92.
- Litman RS (2016) Allaying anxiety in children: when a funny thing happens on the way to the operating room. *Anesthesiology* 115:4- 5. <https://doi.org/10.1097/aln.0b013e318220860b>
- Marechal C, Berthiller J, Tosetti S, Cogniat B, Desombres H, Bouver L, Kassai B, Chassard D, de Queiroz Siqueira M (2017) Children and parental anxiolysis in paediatric ambulatory surgery: a randomized controlled study comparing 0.3 mg kg<sup>-1</sup> midazolam to tablet computer based interactive distraction. *Br J Anaesth* 118(2): 247- 253. <https://doi.org/10.1093/bja/aew436>.
- Marshall GN, Hays RD. (1994).The Patient Satisfaction Questionnaire Short Form (PSQ18). Santa Monica, CA: RAND Corporation. p. 7865.
- Mathias EG, Shivananda M, Kumar V, Guddattu V, Bramhagen A., (2021). Parent Satisfaction Related to Child's Post-Operative Pain Management. *Research square*. DOI: <https://doi.org/10.21203/rs.3.rs-988855/v1>.
- Mifflin KA, Hackmann T, Chorney JM (2012) Streamed video clips to reduce anxiety in children during inhaled induction of anesthesia. *Anesth Analg* 115:1162-1167. <https://doi.org/10.1213/ane.0b013e31824d5224>.
- Perry M, Starkweather A, Baumbauer K, Young E. (2018). Factors leading to persistent postsurgical pain in adolescents undergoing spinal fusion: an integrative literature review. *J Pediatr Nurs*.38:74-80. doi:10.1016/j.pedn.2017.10.013.
- Rabbitts JA, Fisher E, Rosenbloom BN, Palermo TM. (2017). Prevalence and predictors of chronic postsurgical pain in children: a systematic review and meta-analysis. *J Pain*.18:605-14. doi:10.1016/j.jpain.2017.03.007.

- Remo JP, Cavaleiro C, Pina P, Machado MS (2016). Preoperative Anxiety in Preschool Children-Observational Study. *J Anesth Clin Res* 1: 669. doi:10.4172/2155-6148.1000669
- Rosenbloom, BN., Pagé, MG., Isaac L, Campbell, F., Stinson JN, Wright, JG, Katz J. (2019). Pediatric chronic postsurgical pain and functional disability: a prospective study of risk factors up to one year after major surgery. *J Pain Res.*12:3079–98. doi:10.2147/JPR. S210594.
- Rostami, E, Khanjari, S, Haghani, H, Amirian, H. (2022). Effect of video games on preoperative anxiety in 3-6 year-old of a sample of Iranian children undergoing elective surgery. *J Edu Health Promot.*11:135.
- Ryu J-H, Park J-W, Nahm F, et al. (2018). The effect of gamification through a virtual reality on preoperative anxiety in pediatric patients undergoing general anesthesia: a prospective, randomized, and controlled trial. *J Clin Med*; 7:pii: E284.
- Ryu JH, Park SJ, Park JW, et al. (2017). Randomized clinical trial of immersive virtual reality tour of the operating theatre in children before anaesthesia. *Br J Surg*; 104:1628–1633.
- Seiden SC, McMullan S, Sequera-Ramos L, De Oliveira GS Jr, Roth A, Rosenblatt A, Jesdale BM, Suresh S (2014) Tablet-based interactive distraction (TBID) vs oral midazolam to minimize perioperative anxiety in pediatric patients: a non-inferiority randomized Eur J Pediatr trial. *Paediatr Anaesth* 24:1217–1223. <https://doi.org/10.1111/pan.12475>.
- Sjöberg, C, Amhliden, H, Nygren, JM, Arvidsson, S. & Svedberg, P. (2015). The perspective of children on factors influencing their participation in perioperative care. *Journal of Clinical Nursing* 24, 2945–2953.
- Stewart, MW. (2016). Therapeutic Play Intervention. *Journal of perianesthesia nursing.* 31(5), PP. 452–456.
- Thomson, R., (2017). Children 'drive' themselves to operating room. Accessed on 4th April 2021, Available at: <https://www.cbc.ca/news/health/operating-room-pediatricdrive-1.4299347>.
- Tomaszek, L, Cepuch, G, Fenikowski, D. (2019). Influence of preoperative information support on anxiety, pain and satisfaction with postoperative analgesia in children and adolescents after thoracic surgery: A randomized double blind study. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub.* Jun;163(2):172-178. doi: 10.5507/bp.2018.060. Epub 2018 Oct 5. PMID: 30305761.
- Williams, G., Howard, RF., Liossi, C. (2017). Persistent postsurgical pain in children and young people: prediction prevention and management. *Pain Rep.*2:e616. doi:10.1097/PR9.0000000000000616.
- Yun, B., Kim, S., Jung, D., (2015). Effects of a Clown–Nurse Educational Intervention on the Reduction of Postoperative Anxiety and Pain Among Preschool Children and Their Accompanying Parents in South Korea. *Journal of Pediatric Nursing.* 30, e89–e99.