Real-World Application, Utility, and Satisfaction of the Internet-Delivered Preoperative Preparation Program (I-PPP)

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Supervised by Dr. Kristi Wright

University of Regina

By

Courtney Cameron

Regina, Saskatchewan

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Abstract

Preoperative anxiety affects up to 65% of children undergoing a day surgery procedure. This anxiety is associated with a host of negative behaviours and experiences pre-and post-surgery. The use of technology as a means to prepare children for surgery and prevent the development of anxiety is not new, but past approaches have not been comprehensive. More recent endeavours have sought to provide comprehensive surgery preparation via the Internet. The Internet-delivered Preoperative Preparation Program (I-PPP) was developed for the Jim Pattison Children's Hospital in Saskatchewan as an innovation to address the latter (Wright et al., 2017). The I-PPP is an evidence-based, efficacious, interactive Internet-delivered program comprised of five modules designed to help children prepare for their upcoming day surgery and their parents. However, the 'real-world' uptake of the I-PPP is unknown. The current study sought to expand the existing literature by examining 'real-world' uptake (e.g., completed modules), satisfaction with, and effectiveness of the I-PPP in addressing parent-rated child anxiety and parent self-reported anxiety. Parents of seven children undergoing a day surgery procedure were provided access to the I-PPP; however, only four children (mean age = 4.5 years; *SD* = 1.29) had their surgery completed at the time of writing. In terms of engagement, 75% of children and 100% of parents accessed all five modules. The average length of time spent engaged with the program for the child version was 29.51 minutes and 19.48 minutes for the parent version. 100% of parents indicated satisfaction with the program, and 100% indicated that they would recommend the program to others. In terms of parent-rated child anxiety and parent self-report anxiety, no significant changes were observed. Study findings will help support the I-PPP integration into pediatric surgery clinical practice at the Jim Pattison Children's Hospital.

Real-World Application, Utility, and Satisfaction of the Internet-Delivered Preoperative Preparation Program (I-PPP)

It is no secret that an upcoming surgery may introduce many unknown risks and unfamiliar territory for a child (Dehghan et al., 2019; Nabavi et al., 2017). This phenomenon of feelings of worry and nervousness concerning an upcoming surgery procedure is called preoperative anxiety and is experienced by approximately 65% of children (Davidson & McKenzie, 2011; Kain et al., 1996). The perioperative period (the time frame that surrounds the surgery) for a child consists of multiple challenges physically and emotionally. More common biological consequences include increased heart rate, sweating, and trembling (Das & Kumar, 2017). Emotionally, children can experience extreme distress, fear, and agitation (Perry et al., 2012).

Extensive research has been done to illustrate that the induction of anesthesia is a particularly stressful time-point in the surgical process (MacLaren Chorney & Kain, 2009: Davidson & McKenzie, 2011). In some cases, distress is so elevated that children require restraint in order to start the anesthetic induction (Davidson & McKenzie, 2011). Elevated preoperative anxiety is associated with a host of problems post-surgery, such as delirium (Mountain et al., 2011), nightmares, and bedwetting (Perry et al., 2012). Further, negative behaviour changes, including temper tantrums and inconsolable crying among children during the postoperative period has also been observed (Kain et al., 1996: Wright et al., 2017). One longer term concern regarding preoperative anxiety that is when left unaddressed and untreated is that children going forward may develop healthcare-induced anxiety (Lerwick, 2016). Healthcare-induced anxiety may lead to long-term psychological complications such as aggression, anger, and pain when having to seek medical attention (Lerwick, 2013, 2016).

Interventions

As described above, the effects of preoperative anxiety on children have been well-researched and documented throughout the years. As such, various types of interventions have been developed to prevent preoperative anxiety (Finley et al., 2006: Jeon et al., 2018) The two main categories of interventions are (1) pharmacological and (2) non-pharmacological.

Pharmacological Interventions. Pharmacological interventions include traditional medications like midazolam. Midazolam is a benzodiazepine with anxiolytic and amnestic properties (Jeon et al., 2018). Midazolam is utilized widely to address preoperative anxiety in children in some settings, particularly in the United States (Wright et al., 2013: Nauta et al., 2004). While midazolam may be quite popular, studies demonstrate a lack of safety and effectiveness (Jeon et al., 2018). Jeon et al. (2018) reported that although midazolam is a fast-acting anxiety reducer, the postoperative risks like decreased blood pressure and respiratory depression are too risky when preoperative anxiety can be treated through non-pharmacological methods (Griffin et al., 2013; Jeon et al., 2018).

Non-pharmacological Interventions. The focus on non-pharmacological interventions is to decrease anxiety and provide patients with hands-on control of their preoperative care. There are numerous non-pharmacological interventions designed to address preoperative anxiety in children (Eijlers et al., 2017: Wright et al., 2020). Non-pharmacological interventions include but are not limited to: music therapy (Giordano et al., 2020; Wright et al., 2007), role-play modeling (Bautman et al., 2016), hypnosis, acupuncture (Wright et al., 2007), art therapy, clown visits (Costa Fernandes & Arriaga, 2010), parent presence during the perioperative period (Kain et al., 1996; Wright et al., 2007), and lastly Internet-delivered preoperative preparation programs (Kain et al., 2015; Wright et al., 2017). In many of the non-pharmacological interventions, the method of distraction is used to occupy children in a pleasurable activity that utilizes cognitive and motor energy, thus taking away the focus on surroundings (Patel et al., 2006).

Children experience significant anxiety during the anesthesia induction (MacLauren & Kain, 2008). Much of the fear is suggested to be associated with the limited exposure to medical equipment, specifically the anesthetic mask that is used to facilitate anesthetic induction. This mask may make some children feel claustrophobic (Przybylo et al., 2005). Given the aforementioned, one intervention strategy that has been developed and been found to be effective is anesthetic mask shaping and exposure (MacLaren & Kain, 2008; Walker et al., 2019). With this intervention, children are provided a mask similar to what they will see in the operating room, provided graded steps of exposure from holding the mask through placing mask over nose and face, resulting in reduction of fear of the mask (Wright et al., 2017).

The utilization of extensive surgery preparation programs has been one direction for the prevention of and intervention for preoperative anxiety (Fortier et al., 2011; Kain et al., 2007). The ADVANCE Program for children has proven to be highly successful in treating children's preoperative anxiety (Kain et al., 2007). The ADVANCE program is comprised of distraction using a handheld video game, exposure to medical equipment, modeling of proper techniques for parents, education about the process and environment before the day of surgery (Fortier et al., 2011). In an empirical study by Kain et al. (2007), they tested and compared four interventions to treat preoperative anxiety. The sample size consisted of 408 children and their parents. Parent-child groups were randomly assigned to one of four groups: a control group of primary care, parental presence during induction of anesthesia, the preparation program ADVANCE, or medicated via oral midazolam. The Modified Yale Preoperative Anxiety Scale (mYPAS; Kain et al., 1997), an observer-rated measure of child preoperative anxiety, was used to determine the level of anxiety experienced by each group. Results demonstrated that the children in the ADVANCE group were significantly less anxious at anesthetic induction than the children in the other groups (Kain et al., 2007). Most importantly, the children who received the ADVANCE

preparation program had no difference in anxiety levels than those who took midazolam, indicating that an integrated program is just as effective as a pharmacological intervention for anxiety (Kain et al., 2007).

Although the ADVANCE program was shown to be effective in treating preoperative anxiety, Fortier and colleagues (2011) were faced with issues of cost of implementation, intensive use of psychologists, and parent adherence (Fortier et al., 2011; Kain et al., 2007). They suggested that dismantled studies would be required to determine which components are required to be effective (Kain et al., 2007). Fortier et al. (2011) years later conducted a dismantling experiment which found that the two most important components of the ADVANCE program were the child's exposure to medical equipment, specifically the anesthesia mask and use of distraction (e.g., video game) in the preoperative period (Fortier et al., 2011). Overall, ADVANCE was the first fully comprehensive program to change how preoperative anxiety is manageable for children. However, in order to capture the elements of an integrated, intensive program like ADVANCE, it was critical for researchers and clinicians had to create a program and a platform for delivery that did not require traditional face-to-face delivery.

Preoperative Preparation Programs and Technology

Researchers over the years have designed different forms of preoperative preparation aids using technology such as a handheld video game noted above (Kim et al., 2019). For example, Patel et al. (2006) utilized specialty video games for children to reduce anxiety during the preoperative period and at induction of anesthesia. Patel et al. (2006) demonstrated that if children were playing a video game upon entry into the operative room or at the time of anesthesia, their anxiety was significantly less than the children who did not receive a video game. By implementing the technology of a video game, Patel et al. (2006) were able to test the effectiveness of distraction in limiting a child's anxiety.

The Internet has been employed to provide a delivery platform for a more comprehensive approach to preoperative anxiety prevention, akin the ADVANCE program, without the need for face-to-face interaction or the need for dedication psychologists or mental health specialists (Kim et al., 2019). The main two are the Web-based Tailored Intervention for Preparation (WEBTips) (Kain et al., 2015) and the Internet-delivered, Preoperative, Preparation Program (I-PPP) (Wright et al., 2017), both of which combine comprehensive and evidence-based interventions. Both WEBTips and the I-PPP have shown effectiveness in treating preoperative anxiety in children compared to standard hospital procedures (Kim et al., 2019). It is important to note that the development of the I-PPP came before the publication of WEBTips (Fortier et al., 2015). WEBTips addresses the anxiety of children aged 4 to 7 and parents of kids aged 2 to 7 years old (Kain et al., 2015). WEBTips components include: medication, procedural information, peer-modeling, and coping skills for both child and parent (Kim et al., 2019). WEBTips allows flexibility with the program's ability to adjust its intervention strategies based on the circumstances (Wright et al., 2017). Due to the tailored preoperative anxiety treatment plan, researchers questioned the widespread applicability of WEBTips as it required health care staff resources to collect questionnaire data and invited parents to provide their preference for using a pharmacological aid (e.g., midazolam) to developing each plan (Wright et al., 2017). The latter point (i.e., parents are invited to provide their preference for using a pharmacological aid) makes the WEBTips program less applicable in Canada as Canadian anesthesiologists are much less likely to employ a pharmacological aid to address preoperative anxiety.

The Internet-delivered Preoperative Preparation Program (I-PPP)

The Internet-delivered Preoperative Preparation Program (I-PPP) is comprised of five modules aimed at helping children and parents navigate everything to expect and prepare for leading up to surgery (Wright et al., 2017). Module one is a virtual tour of the Jim Pattison

Children's Hospital admission area, day surgery room, and holding area to teach children and parents what to expect on surgery day. Module two consists of educating children and parents about anesthesia. Module three consists of identifying the emotional and mental aspects of a day surgery experience. Module four consists of mask shaping and exposure to an anesthetic mask (the mask is provided to the family). The fifth module is comprised of practicing the skills to aid in the day surgery process. Also, the program is divided into two paths, one for children and one for parents (Wright et al., 2020). These modules are narrated by a penguin cartoon named Ippy so that the program can incorporate an audio component and visuals (Wright et al., 2017).

WEBTips and I-PPP are considered very similar, with differences mainly revolving around the WEBTips procedure, which allows for decisions between intervention strategies (Wright et al., 2017). When the I-PPP was compared to the benchmark WEBTips (Fortier et al., 2015; Wright et al., 2017) and ADVANCE (Kim et al., 2019; Wright et al., 2017) study outcomes (i.e., mYPAS scores), observer-rated anxiety (i.e., mYPAS scores) did not differ significantly across I-PPP, WEBTips, and ADVANCE. The latter findings suggested that the programs had similar effectiveness (Wright et al., 2017). In a follow-up study of efficacy, the I-PPP was compared to a treatment as usual (TAU) condition in 104 children undergoing day surgery procedures (Wright et al., 2021). Results demonstrated that the I-PPP was superior to TAU in terms of anxiety reduction throughout day surgery and induction compliance. The timing of the delivery of the I-PPP was also explored (Wright et al., 2020). Specifically, the effectiveness of the I-PPP was explored when the I-PPP was completed at home prior to the day of surgery versus when the I-PPP was completed via a handheld tablet by 80 children at the hospital on the day of the surgery procedure (Wright et al., 2020). Results indicated that there was no effect for the timing of the delivery, although a small subset of the parents, parents who were in the group who completed the I-PPP at the hospital group, indicated that the I-PPP was

beneficial but felt that the benefits of the I-PPP would be even greater if they would have had access to the program prior to the day of surgery (which is how the program is designed).

Internet-Delivery of Mental Health Programs

The delivery of the I-PPP or other Internet-delivered psychological intervention programs is beneficial to all parties involved as it allows for flexibility, clear communication and education for patients, and wide accessibility (Wright et al., 2020). However, it is unknown what the 'real-world' uptake of the I-PPP would be. Research has identified a number of factors that may contribute to whether an Internet-delivered program is going to have high engagement, completion, and adherence (Fleming et al., 2018; Wright et al., 2020). Some of the factors include the number of modules to be completed by the user, the number of times the user has logged onto the program, the type of graphics, and the patient-observed improvements (Fleming et al., 2018). Internet-delivered interventions have been around for about 20 years (Andersson, 2018). Anderson et al. (2019) makes strong claims that online delivered cognitive behavioral therapy is successful in its uptake in communities.

The unprecedented times of the global pandemic have begun to shift interventions to online delivery. During COVID-19, there was an increase in the utilization of Internet-delivered tools to treat mental health concerns due to accessibility and public health restrictions for safety (e.g., physical distancing, isolation) (Soklaridis et al., 2020). The forced adaptation of delivering mental health supports increased research in Internet-delivered synchronous and asynchronous programs (Soklaridis et al., 2020). One of the critical benefits of Internet-delivered programs is that they allow for patients to have control in their health care treatment (Soklaridis et al., 2020). For example, internet-delivered cognitive behaviour therapy (ICBT) has become a topic of recent research illustrating that 78% of patients adhere to the ICBT and would recommend the program to others (Hadjistavropoulos et al., 2017: Jolstedt et al., 2018). In the case of treating

preoperative anxiety, this would indicate that the I-PPP offers a more encompassing approach to health care.

Purpose and Hypotheses

The purpose of this study was to examine the 'real-world' application, utility, and satisfaction with the I-PPP in children undergoing a day surgery procedure at the Jim Pattison Children's Hospital. Research has demonstrated that the use of Internet-delivered programs has proven to decrease the amount of anxiety experienced by children (Hadjistavropoulos et al., 2017; Jolstedt et al., 2018; Wright et al., 2020). However, there is a relatively limited number of studies in research, or the research that does exist is very limited in its analysis of parent engagement and satisfaction of Internet-delivered intervention programs delivered in a 'real-world' setting. In this study, there were 5 primary hypotheses: (1) parent-child pairings would access the program; (2) parent-child pairings would complete the program; (3) parents would be satisfied with the program; (4) a positive association would be observed between program engagement and program satisfaction, and (5) anxiety in children and parents would decrease from pre- to post-surgery.

Method

Measures

Demographics form. Parents/guardians completed a demographics form for their child, that included personal (e.g., age, sex, ethnicity) and health (e.g., previous surgeries, type of surgery) demographic questions. Parents/guardians completed demographic questions for themselves across personal (e.g., age, sex, ethnicity) demographic questions.

Spence Children's Anxiety Scale -Parent Report Brief Version (SCAS-P-8; Spence, 1998: Reardon et al., 2018). The SCAS-P-8 is a brief version of the Spence Children's Anxiety

Scale (SCAS) designed to assess parent-rated child anxiety (Spence, 1998: Reardon et al., 2018). The SCAS-P-8 includes items that address generalized anxiety disorder, separation anxiety disorder, panic/agoraphobia, and social anxiety (Reardon et al., 2018). Each item is rated on a 4-point Likert scale, ranging from 0 (never) to 3 (always). Items are summed to obtain a total score, with higher scores indicating higher levels of anxiety in the child (Reardon et al., 2018). The internal consistency of SCAS-P-8 ranges from an acceptable to good level (Reardon et al., 2018).

State Trait Anxiety Inventory Scale (STAI; Spielberger et al., 1983). The STAI was designed to assess self-reported parent state (situational) and trait anxiety. The STAI is comprised of 40 items. The first 20-items are designed to assess situational anxiety (STAI-S) while the other 20-items are designed to measure trait anxiety (STAI-T). Items are rated on a 4-point Likert scale, with a total score that ranges from 20 to 80 (Spielberger et al., 1983). A higher score indicates increased anxiety (Spielberger et al., 1983). Both STAI-S and STAI-T have a range of good to excellent internal consistency (Spielberger et al., 1983). For the current study, both versions of the STAI were employed. STAI-S was completed at pre- and post-surgery time-points, whereas the STAI-T was only completed at pre-surgery.

Client Satisfaction Questionnaire-8 (CSQ-8; Larsen et al., 1979). The CSQ-8 is a brief 8-item measure designed to assess client satisfaction with the I-PPP. The items on the CSQ-8 are rated on a 4-point scale ranging from 1 to 4, with the total score ranging between 8 and 32 (Larsen et al., 1979). A total score of 32 suggests there is high participant satisfaction (Larsen et al., 1979).

Digital Behaviour Change Interventions Engagement Scale (**DBCI Engagement Scale; Perski et al., 2019**). The DBCI Engagement Scale is an 8-item measure scored on a 7-point Likert scale with end points “not at all” and “extremely”, with a total score ranging from 8

to 56 in which higher scores indicate higher engagement (Perski et al., 2019). The DBCI is comprised of two subscales connected to experience and behaviour (Perski et al., 2019). For the current study, the DBCI total score related to the mentioned subscales was utilized to determine participant engagement with the I-PPP.

User engagement. User engagement was also assessed by collecting specific program information. Specifically, number of modules completed, time engaged in each module, and time to complete the program.

Participants

Parents of seven children, ages 3 to 8 years old (mean age = 4.5 years; *SD* = 1.29), undergoing a day surgery procedure at the Jim Pattison Children's Hospital and seven parents were provided access to the I-PPP. Four parents and their children accessed the program and had surgery completed at the time of writing. Parents provided consent and child assent before participation. Inclusion criteria included: (1) child undergoing a day surgery procedure (e.g., tonsillectomy/adenoidectomy, myringotomies, dental work) at the Jim Pattison Children's Hospital, (2) parent can read and understand English, and (3) parent can access a device to access the Internet. Recruitment for the study was arranged via the principal investigator who contacted various surgeon offices to recruit potential child participants, who were then contacted directly by phone.

Procedure

Participants (i.e., parents of children ages 3-8 years undergoing a day surgery procedure at the Jim Pattison Children’s Hospital) were provided a link via email to the study information, consent form, and baseline measures (i.e., demographics form, STAI, SCAS-P-8) via Qualtrics within one week before scheduled surgery. Participants were asked to respond to our email with a home mailing address so an anesthetic mask could be sent to their home (i.e., to be used along

with the I-PPP). Once baseline measures were completed by participants, they were able to use their username and password to access the I-PPP. Following the surgery, parents received a follow-up email to complete the following post-surgery measures; the STAI-S, SCAS-P-A, DBCI, and CSQ-8.

Statistical analyses

Statistical analyses were completed using the IBM SPSS Statistics software package (SPSS: version 26). Descriptive statistics were computed for demographic variables and measures of interest. Preliminary analyses were completed to examine impact of age on parent-rated child anxiety and parent anxiety at pre- and post-surgery. Four separate sets of bivariate correlations were computed between age and anxiety at pre- (i.e., parent-rated child anxiety and parent state/trait anxiety) and post-surgery (i.e., parent-rated child anxiety and parent state anxiety). Three sets of the primary analyses were completed. First, five separate t-tests were computed to examine group differences in engagement in the individual modules and program completion (i.e., minutes spent in module). Second, a bivariate correlation was computed between measures of parent-rated engagement with the I-PPP and satisfaction to examine the association between these two variables. Third, two separate dependent sample t-tests were completed to examine changes in self-reported parent anxiety and parent-rated child anxiety from pre- to post-surgery.

Results

Demographic Analyses

Descriptive statistics were computed for child and parent demographic information (see Tables 1 and 2). A total of seven parents and their children aged 3-8 years were provided access to the I-PPP. At the time of writing four parents and children had accessed the I-PPP and had surgery completed. Analyses will be presented on these four children and parents. Preliminary

Table 1. Child Participant Demographics.

Demographic Variables	**M (*SD*)**
Age	4.5(1.29)
	% (n)
Sex	
Boy	25(1)
Girl	50(2)
Gender fluid	25(1)
Ethnicity	
White/Caucasian	50(2)
Asian	25(1)
Other	25(1)
Previous surgery, Yes/No %	50/50
Current surgical procedure categories	
ENT	25(1)
Urology	50(2)
Cardiology	25(1)

Table 2. Parent Participant Demographics.

Demographic Variables	**M(SD)**
Age	36.25(2.63)
STAI-Trait	44.67(3.21)
	% (n)
Sex	
Man	25(1)
Woman	75(3)
Ethnicity	
White/Caucasian	50(2)
Asian	25(1)
Other	25(1)
Education	
Some University	25(1)
University Diploma	25(1)
University Degree	25(1)
M.A.	25(1)
Relationship status, % Divorced	100
Residence	
Urban	50(2)
Rural	50(2)

analyses demonstrated no significant associations between child age and parent-rated anxiety at pre- or post-surgery, r = .98 p = .12: r = -.98 p = .12, respectively. For parents, similarly no significant association was observed between parent age and trait anxiety, r = .15 p = .90, or state anxiety at pre- or post-surgery, r = -1.00 p = .00: r = .87 p = .33, respectively. No gender analyses were completed as gender in the current sample was unevenly distributed.

Engagement and Satisfaction with the I-PPP

Descriptive statistics were computed for indices of engagement (see Table 3). With respect to engagement with the I-PPP program itself (i.e., program access and time spent completing the program and modules), we provided access to the program to seven parent-child pairings, and four had accessed and had surgery completed by time of writing. Of the four parent-child pairings that accessed to the program, three children (75%) and four parents accessed the entire program (100%).

For children, the average time spent engaged in completing the I-PPP was 29.51 minutes (see Table 4). For parents, the average time spent engaged completing the program was 19.02 minutes. Time spent completing the I-PPP was further broken down by its modules (see Table 5). On average, children spent the most time engaged with Module 1: Virtual tour of the hospital with a mean time of 20.21 minutes (versus parents: mean time = 5.63 minutes); however the group difference was not significant due to variation in engagement time, $t(5) = 0.89$, p =.42. Parents spent the most time on Module 4: Managing Anxiety about Surgery with a mean time of minutes 6.75 minutes (versus children: mean time = 2.60 minutes), however the group difference was not significant due to variation in engagement time, $t(5) = 0.89$, p =.42. Note, our sample is particularly small to complete analyses assessing group differences.

Descriptive statistics for the DBCI Engagement Scale (Perski et al., 2019) were computed (see Table 4). The mean DBCI total score was 29.67 (SD = 8.33).

Table 3. Indices of Engagement and Satisfaction with the I-PPP.

Measure	**M (SD)**
DBCI	29.67(8.33)
CSQ-8	31.33(1.15)
	%(n)
All modules completed	
Child	75(3)
Parent	100(4)

Note: DBCI = Digital Behaviour Change Interventions Engagement Scale; CSQ-8 = Client Satisfaction Questionnaire-8.

Table 4. Group Differences in Module and Program Completion.

Modules	**Child M (minutes) (SD)**	**Parent M (minutes) (SD)**	***t***	**p**
Module 1: Jim Pattison Children's Hospital Virtual Tour	20.20(33.50)	5.63(4.73)	0.89	.42
Module 2: Anesthesia Education	1.34(2.47)	2.60(1.74)	0.89	.42
Module 3: Feelings & Behaviour	3.47(2.81)	2.44(1.89)	0.58	.58
Module 4: Managing Anxiety About Surgery	2.60(1.44)	6.75(7.82)	0.89	.42
Module 5: Practice	3.70(3.73)	0.40(0.33)	1.34	.12
Total Program	29.51(46.33)	19.48(13.98)	0.42	.69

Note: Descriptives statistics computed based on 3 children who accessed the program.

The mean total score obtained is in the upper range of the range of possible scores (i.e., 8-56).

With respect to satisfaction (as measured by the CSQ-8), overall 100% of participants who completed the post-measures (n = 3) indicated they were “very satisfied” with the I-PPP. 100% of parents indicated that they would recommend the program to others and felt that they received ‘excellent service”. 100% of participants also indicated that the I-PPP helped them effectively deal with their problems (i.e., upcoming child surgery). In terms of the I-PPP meeting all their needs, 66.7% of participants felt the I-PPP met all their needs, and 33.3% of participants felt the I-PPP met most of their needs.

We anticipated that we would compute a bivariate correlation between indices of satisfaction (i.e., CSQ-8) and engagement (i.e., DBCI) to understand the association between satisfaction and engagement with the I-PPP. However, our sample was too small to compute this analysis.

Changes in Parent Anxiety and Parent-Rated Child Anxiety

Descriptive statistics were computed for parent-rated child anxiety and parent self-report anxiety (see Table 5). Two separate dependent sample t-tests were conducted to assess the changes in parent-rated child anxiety (SCAS-P) and parent anxiety (i.e., STAI-state) from pre- to post-surgery (see Table 3). Results demonstrated no significant changes in parent-rated child anxiety, $t(2) = .289$, $p = .80$. Similarly, no significant changes in changes in parent state anxiety from pre- to post-surgery, $t(2) = -.078$, $p = 0.95$. However, it is important to note that parent anxiety was somewhat lower at post-surgery. As noted above, our sample is particularly small to complete analyses assessing group differences.

Table 5. Group Differences in Parent-rated Child Anxiety and Parent Self-reported Anxiety.

Child	**SCAS-P-8 Total Score Pre-Surgery M(SD)**	**SCAS-P-8 total score Post-Surgery M(SD)**	***t***	***p***
	4.67(3.06)	3.67(3.06)	0.29	0.80
Parent	**STAI-S Pre-Surgery M(SD)**	**STAI-S Post-Surgery M(SD)**		
	42.00(3.00)	42.33(4.62)	0.07	0.95

Note: SCAS-P-8 = Spence Children's Anxiety Scale -Parent Report Brief Version; STAI-S = State Trait Anxiety Inventory Scale -State

Discussion

Upwards of 65% of children undergoing a day surgery procedure experience anxiety (Davidson & McKenzie, 2011; Kain et al., 1996). This anxiety is associated with a host of negative behaviours and experiences pre-and post-surgery (e.g., crying, screaming, bed wetting). The use of technology as a means to prepare children for surgery and prevent the development of anxiety is not new (Kim et al., 2019), but past approaches have not been comprehensive.

Recently the I-PPP was developed as a comprehensive manner to prepare children for an upcoming day surgery and prevent the development of preoperative anxiety for children undergoing a day surgery procedure at the Jim Pattison Children's Hospital in Saskatchewan (Wright et al., 2017). The I-PPP has been deemed effective and efficacious (Wright et al., 2017; Wright et al., 2020; Wright et al., 2021). However, it remained unknown what the 'real-world' use of the I-PPP would be. The purpose of the current study was to explore the 'real-world' application and acceptance of the I-PPP.

In Hypothesis 1 it was predicated that parent-child pairings would access the I-PPP. The hypotheses was partially supported. We provided access to seven parent-child pairings and four accessed the program itself. We do not know why the three parents/children did not access the program. We can speculate that some may not have wanted to complete the pre-post measures, which then negated their access to the I-PPP.

In Hypothesis 2 it was predicted that parent-child pairings would complete the program. The hypothesis was primarily supported in that three children (75%) and four parents had accessed the entire program (100%). Children appeared to spend more overall time engaged in the child version of the program (i.e., 29.51 minutes) than the parents in the parent version (i.e., 19.48 minutes), although the difference was not statistically different. Children spent more time engaged in Module 1: Virtual Tour (mean = 20.21 minutes) than parents (= 5.63 minutes);

however the group difference was not significant. In contrast, parents spent the most time on Module 4: Managing Anxiety about Surgery (mean = 6.75 minutes) than children (mean = 2.60 minutes), however the group difference was not significant. Important to note the group analyses are underpowered so it will be important to interpret the results with caution.

In terms of assessment of engagement with the I-PPP as a digital resource, parents completed the DBCI Engagement Scale. The mean total score for the DBCI was 29.67 (*SD* = 8.33). The mean total score obtained is in the upper range of the range of possible scores (i.e., 8-56), suggesting that our parents were engaged in the I-PPP. Taken together, the aforementioned indices of engagement provide preliminary evidence of good engagement with the I-PPP.

In Hypothesis 3 it was predicted that parents will be satisfied with the program as measured by the CSQ-8. This hypothesis was supported. Across CSQ-8 items and total score, almost 100% parents responded positively regarding being "very satisfied" with the I-PPP, indicating they would recommend the program to others, feeling they received 'excellent service". Parents also positively endorsed that the I-PPP helped them effectively deal with their child's upcoming surgery and felt that they had all or almost all their needs met. We also received a number of very positive anecdotal comments about the program (e.g., positive comments about the virtual tour, Ippy, mask exposure). Comments were consistent with previous studies where the strengths of the I-PPP were outlined and satisfaction rated (Wright et al., 2017; Wright et al., 2020; Wright et al., 2021). Collectively, the I-PPP has received exceptional support from parents/children who have accessed the program. Further data collection examining the 'real-world' uptake of the I-PPP will provide us additional insights to the acceptability of the program.

In Hypothesis 4 it was predicated that a positive association would be observed between program engagement and program satisfaction. Due to the small size of our current sample, we

were not able to complete this analysis. With a larger sample size, we anticipate exploring the association between program engagement and program satisfaction.

In Hypothesis 5 it was predicted that anxiety in children and parents will decrease from pre- to post-surgery. Results did not confirm this hypothesis. While previous studies of the I-PPP have already deemed it effective in reducing preoperative anxiety in children compared to children who did not receive the I-PPP, those studies used a different approach to measuring child anxiety. In the past, the I-PPP has been assessed using the observer-rated modified Yale Preoperative Anxiety Scale (mYPAS; Kain et al., 1997), whereas the current study utilized a parent-rated measures of anxiety (i.e., SCAS-P-8). The differences in the measurement of child anxiety in the current study versus previous studies may partially explain our current findings, however our sample size is small, and therefore our current findings should be interpreted with caution. A larger sample size will allow us to better understand the utility of the I-PPP in reducing parent-rated child anxiety.

Limitations and Future Directions

The current study has a number of limitations that required consideration and acknowledgement. First, the study sample size is notably small (i.e., seven parent-child pairings with four parent-child pairings accessing the program). The data collection and current sample size was impacted by the lack of centralized surgery scheduling for children undergoing surgery at the Jim Pattison Children's Hospital. The principal investigator was required to contact surgeon offices individually to recruit participants for this study and then the research coordinator was required to set up program access for the parents/children to access. In addition, we were unable at this time to link the I-PPP program to the Jim Pattison Children's Hospital website and therefore parents could not access the program on their own. Collectively these factors impact the ability for us to fully assess the 'real-world' uptake of the program. Data

collection for this study will continue over the next two years, ultimately reaching the goal of a sample size of 200 children. Since this study is ongoing, the benefit of eventually obtaining a larger sample size will aid in establishing the generalizability of our findings. In future studies, it is hoped that the I-PPP can branch out to other provinces in Canada, allowing for the promotion of implementing parent-directed interventions in pediatric surgery departments.

Secondly, this study used parent self-report measures to measure preoperative anxiety and the associated variables of interest with the I-PPP (i.e., engagement, satisfaction). As a function of the range of the age of the participants (i.e., three through eight years) targeted by this study and method of data collection (i.e., online) we chose to employ parent-rated measures. In particular, this current study used a parent-rated anxiety measure (i.e., SCAS-P-8). As noted above, it is unknown whether this method of measurement will impact the ability to assess the utility of the I-PPP in reducing child anxiety.

Lastly, this study was conducted during the COVID-19 pandemic, which caused delays in completing an update to the I-PPP program (i.e., new pictures for the virtual tour), obtaining research ethics approval, and increased wait-times for surgical procedures. Moving forward with the lessening of COVID-19 restrictions and precautions in Saskatchewan, it is hopeful that surgical capacity will resume, and data collection will run quicker.

Conclusion

This study was the next step in this line of research and clinical application to explore the ‘real-world’ application and acceptance of the I-PPP. These preliminary findings demonstrate good engagement with the I-PPP and excellent program satisfaction. These preliminary findings support that implementing Internet-delivered preparation programs before a child's surgery, such as the I-PPP, will help improve the day surgery experiences for children undergoing day surgery procedures at the Jim Pattison Children’s Hospital. Understanding the association between

program engagement on satisfaction will help inform and direct ways to integrate the I-PPP into the busy day surgery department at the Jim Pattison Children's Hospital. Additionally, the knowledge and insight gained from this study about Internet-delivered programs will help create and adjust current interventions in older populations.

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