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Abstract

The study comprised a prospective, comparative cross-sectional survey in 143 children undergoing tonsil surgery. Parents answered the Post Hospitalization Behavior Questionnaire for Ambulatory Surgery (PHBQ-AS), and children answered the questionnaire Postoperative Recovery in Children (PRiC). The PHBQ-AS had positive correlation with the PRiC and with general health. On day 10 after surgery, up to 1/3 of the children still reported physical symptoms (PRiC). No gender or age differences concerning the items of behavior (PHBQ-AS) were found. The quality of postoperative recovery (PRiC) in girls was lower, with higher levels of nausea, dizziness, coldness, and headache compared to the boys. Children <6 years of age reported higher levels of dizziness, and lower sleep quality and lower general health.

Keywords: Behavior, Children, Pain, Postoperative recovery, Tonsil surgery
Introduction

Postoperative recovery in children is an individual process with subjective experiences, affecting daily life activities, physical and emotional comfort (Eriksson, Nilsson, Bramhagen, Idvall, & Ericsson, 2017), and behavioral changes (Karling, Stenlund, & Hägglöf, 2007; Wilson et al., 2016). Tonsil surgery is a frequently performed surgical procedure among children, and behavioral disturbance has been reported as a common complication (Karling et al., 2007; Sathe, Chinnadurai, McPheeters, & Francis, 2017; Stanko, Bergesio, Davies, Hegarty, & Ungern-Sternberg, 2013; Wilson et al., 2016). The most frequent behavioral changes were apathy and separation anxiety (Fortier, Del Rosario, Rosenbaum, & Kain, 2010; L. Kotiniemi, Ryhänen, & Moilanen, 1997; L. H. Kotiniemi, Ryhänen, & Moilanen, 1996), eating disturbances (Eriksson et al., 2017; Karling et al., 2007; L. Kotiniemi et al., 1997; L. H. Kotiniemi et al., 1996; Sathe et al., 2017), and sleep disturbance (Eriksson et al., 2017; Karling et al., 2007; L. Kotiniemi et al., 1997; L. H. Kotiniemi et al., 1996), “making a fuss about eating,” and “temper tantrums” (Beringer, Segar, Pearson, Greampet, & Kilpatrick, 2014). Preoperative anxiety has been found to be a risk factor for, for example, postoperative pain, sleeping problems, and eating problems after surgery (Kain, Mayes, Caldwell-Andrews, Karas, & McClain, 2006). Young age (Fortier et al., 2010; Karling et al., 2007; Stargatt et al., 2006) and being a boy (Beringer et al., 2014) have also been reported as risk factors for behavioral changes postoperatively. Even long-lasting problematic behavior persisting for up to four weeks after surgery has been found in 16%–32% of children (Pearson & Hall, 2017; Stargatt et al., 2006). Day-case tonsil surgery plays a prominent role in pediatric practice in many countries (Hallenstål et al., 2017).

In 1966, Vernon, Schulman, and Foley developed a parent-rated instrument, the Post Hospital Behavior Questionnaire (PHBQ), to quantify behavioral changes in children who undergo
hospitalization due to surgery or illness in the United States (Vernon, Schulman, & Foley, 1966). The PHBQ comprises 27 items in six subscales: general anxiety and regression, separation anxiety, eating disturbance, aggression toward authority, apathy/withdrawal, and anxiety about sleep. For each item, parents are asked to compare their child’s behavior before hospitalization to the child’s current behavior (post-hospitalization) on a Likert-type scale (Vernon et al., 1966). The PHBQ has been translated into Swedish, and its psychometric properties were found to be acceptable (Karling, Stenlund, & Hägglöf, 2006). The Swedish PHBQ includes 25 items. Two items, Does your child need a lot of help doing things? and Is it difficult to get your child to talk to you?, loaded poorly on any factor (<0.4), and when this was evaluated by an expert panel these questions were omitted (Karling et al., 2006).

In 2015, Jenkins and colleagues (Jenkins et al., 2015) reduce the number of items from 27 to 11, creating the Post Hospitalization Behavior Questionnaire for Ambulatory Surgery (PHBQ-AS). The PHBQ-AS demonstrated good internal consistency, reliability, and concurrent validity (Jenkins et al., 2015). Since most of the tonsil surgeries among children are performed on a day surgery basis (Alm, Stalfors, Nerfeldt, & Ericsson, 2017), we created a modified version of the PHBQ-AS to test construct validity and internal consistency and to measure behavioral changes in children undergoing tonsil surgery.

The instrument Postoperative Recovery in Children (PRiC) was recently developed and tested in Sweden as a questionnaire aiming to measure self-reported postoperative recovery after tonsillectomy in children aged 4–12 years. The results of the study provided evidence of the reliability and validity of the PRiC as a measure of postoperative recovery among children after tonsil surgery. Cronbach’s alpha for the total questionnaire was 0.83. The parents reported in 59% of the cases that the children participated very much in answering the questions (Bramhagen et al., 2016). However, continued psychometric testing of
questionnaires measuring postoperative recovery and post hospital behavior are needed, as well as an assessment of these outcomes.

**Purpose**

The study objectives were to (1) examine the psychometric properties of the modified Swedish version of the Post Hospitalization Behavior Questionnaire for Ambulatory Surgery (PHBQ-AS), (2) describe post-hospitalization behavior and postoperative recovery in children undergoing tonsil surgery, and (3) explore any gender or age differences in connection with these aspects.

**Methods**

**Study Design and Population**

The study employed a prospective, comparative cross-sectional survey. A sample of 390 children undergoing tonsil surgery (tonsillectomy or tonsillotomy/partial tonsillectomy) and their parents were invited to participate in answering one questionnaire each on day 10 after surgery. The children were consecutively recruited from five different settings, four hospitals and one private day surgery clinic, in Sweden in 2012–2014. The inclusion criteria were as follows: healthy children without any chronic disease between the ages of 4 and 12 years, who were selected for day surgery and whose parents could read, understand, and speak Swedish.

**Questionnaires**

*Post Hospitalization Behavior Questionnaire for Ambulatory Surgery*

The modified version of the PHBQ-AS consisted of nine items, that is, the two items excluded in the Swedish version of PHBQ was also excluded in the PHBQ-AS version. The two
excluded items were *Is it difficult to get your child to talk to you?* and *Does your child need a lot of help doing things?* The nine items were answered by the parents on a five-point scale: 1 = much less than before, 2 = less than before, 3 = same as before, 4 = more than before, and 5 = much more than before.

*Postoperative Recovery in Children*

Postoperative recovery was measured with the PRiC, by the children themselves or with help from the parents. The PRiC includes 23 items, 21 items about different aspects of recovery in general and 2 items that are specific to tonsil surgery (ear ache and blood in the mouth). The items concern the previous 24 hours and are assessed on a four-grade scale: 1 = not at all, 2 = a little, 3 = much, and 4 = very much, where “very much” indicates the lowest level of recovery. The PRiC also includes one item of a more general nature that addresses the children’s present general health, to be answered with: 4 = very good, 3 = pretty good, 2 = pretty bad, or 1 = very bad.

Background data were collected from the child’s medical journal using a protocol developed a priori, concerning gender, age, surgical procedure, and type of anesthesia.

*Procedure*

The invited children and their parents received verbal and written information about the study. At discharge from the hospital, the children received the PRiC questionnaire for assessing postoperative recovery on the 10th day postoperatively. Their parents received the Swedish version of the PHBQ-AS, also to be answered on the 10th day postoperatively, along with prepaid envelopes. No reminder was sent out.

*Ethical Approval*
The study was approved by the Research Ethics Committee in Uppsala (No. 2012/106).

Parents provided written informed consent for the study, and the children provided assent. The children could either write their name or draw a picture on the consent form. The researcher stated that children could withdraw from the study at any time. Data sheets were stored in a locked cabinet and no identifying information was collected.

Statistics

Power Calculation

Based on the suggestions by Ferketich (1991) of a five-to-one ratio (five individuals per scale item) for examining psychometric properties in a nine-item instrument, a minimum of 45 participants would be needed to conduct principal components analysis (Ferketich, 1991). Therefore, our sample size provided sufficient power to conduct psychometric testing of the Swedish modified version of PHBQ-AS.

Validity to evaluate the accuracy was assessed as follows:

1. Principal components analysis: Although the PHBQ-AS (Jenkins et al., 2015) was developed during the time of data collection of the present study, a decision was made to determine construct validity of the Swedish version of the PHBQ-AS, using a principal components analysis with varimax rotation rather than presenting all 25 items, that is, the Swedish version of the PHBQ.

2. Construct validity is the degree to which the scores of a questionnaire are consistent with hypotheses based on the assumption that the questionnaire validity measures the construct to be measured. For a correlation coefficient $0.3 < r < 0.7$, moderate correlation was assumed.
3. **Hypothesis testing:** To analyze construct validity, a priori hypotheses were set up, hypothesizing that the PHBQ-AS would correlate moderately positively with the PRiC and with general health measured with Spearman rank (\( \rho \)) correlation coefficients.

**Internal consistency (reliability)** describes consistency and was assessed based on the following: Cronbach’s alpha coefficient was calculated to determine the homogeneity of each factor among the items in the PHBQ-AS.

**Analysis of the Post Hospitalization Behavior Questionnaire for Ambulatory Surgery and Postoperative Recovery in Children**

1. Parent-reported behavioral changes, PHBQ-AS, are presented as frequencies and proportions.

2. The self-reported items of the PRiC are presented with mean and standard deviation (SD) and with the frequencies for all answers in each item.

3. Age was categorized dichotomously as younger children (<6 years) or older children (\( \geq 6 \) years), guided by the mean age 6.5 years of the included population. Ages were compared using the Mann Whitney U-test.

4. Differences between genders were analyzed with Mann Whitney U-test.

All statistical analyses were conducted with SPSS 23.0 (SPSS Inc., Chicago, IL, USA).

Descriptive statistics are presented as numbers and percentages, arithmetic means, and medians. A \( p \)-value less than 0.05, two-tailed, was considered statistically significant.

**Results**

On the 10th day after the surgical procedure a total of 37% \( (n = 143) \) of the included children answered the PRiC, while their parents answered the PHBQ-AS. The mean age of the responding children was 6.5 years (SD 2.3); 58% were girls \( (n = 82) \) and 42% boys \( (n = 61) \).
Half of the children underwent adenotonsillotomy ($n = 60$) or tonsillotomy ($n = 7$), and the other half underwent adenotonsillectomy ($n = 41$) or tonsillectomy ($n = 35$). The main indications for the procedures were airway obstruction/hypertrophic tonsils ($n = 112$), infection/inflammation such as recurrent tonsillitis ($n = 16$), and “chronic” tonsillitis ($n = 15$). The types of anesthesia were inhalation (78%, $n = 112$) and total intravenous anesthesia (22%, $n = 31$).

**Psychometric Properties**

A principal components factor analysis with varimax rotation was conducted, using the nine remaining items of the PHBQ-AS to determine whether the Swedish version was unidimensional. The principal components analysis resulted in a one-factor solution explaining 50.8% of the total variance (Table 1). The Cronbach’s alpha was 0.86. Construct validity showed a low positive correlation between the PHBQ-AS and PRiC, $\rho = -0.25$, $P = 0.003$ and a moderate correlation between PHBQ-AS and general health, $\rho = -0.30$, $P = 0.000$. On item level, low positive correlations were found between seven PHBQ-AS items and 13 PRiC items. The strongest correlation was found between the items PHBQ-AS *Does your child make a fuss about eating?* and the PRiC items *difficulty eating* ($\rho = 0.31$, $P = 0.000$) and *sore throat* ($\rho = 0.30$, $P = 0.000$). The highest frequencies of correlations were found in the two PHBQ-AS items measuring fuss about eating and poor eating. No correlations were found between two of the PHBQ-AS items, *Does your child have bad dreams at night or wake up and cry?* and *Does your child get upset when you leave him (or her) alone for a few minutes?*, and any of the PRiC items (Table 2).

**Behavioral Changes, PHBQ-AS**

The most frequently reported negative behavioral changes were fuss about eating (17%, $n = 28$) and having a poor appetite (17%, $n = 28$) (Figure 1). There were no significant differences
Postoperative Recovery (PRiC)

The item general health was scored to be rather good, 3.7 (SD 0.5), and the majority of the children had a relatively high quality of recovery on postoperative day 10, with 61%–98% reporting no symptoms or difficulties. The most frequently reported symptoms were sore throat (39%), difficulties with eating (28%), feeling sad (20%), and feeling cold (18%). Twenty percent of the children reported difficulties with attending daycare or school (Table 3). Younger children reported more difficulties with dizziness, 1.3 vs 1.1 ($P = 0.009$), and sleep 1.3 vs 1.1 ($P = 0.042$), compared to the older children. There were no differences in the other 21 items. Girls suffered more from nausea, 1.1 vs 1.0 ($P = 0.048$); dizziness, 1.2 vs 1.0 ($P = 0.009$); coldness, 1.4 vs 1.1 ($P = 0.001$); and headache, 1.2 vs 1.0 ($P = 0.002$), compared to the boys. There were no differences in the other 19 items. A difference in age was also seen in the item general health, in which younger children assessed lower levels of health compared to the older ones, 3.6 vs 3.8 ($P = 0.021$). No differences were observed between genders.

Discussion

The study examined a parent-reported questionnaire about post-hospitalization behavior, PHBQ-AS (Jenkins et al., 2015), together with a child-reported questionnaire about postoperative recovery, PRiC (Bramhagen et al., 2016), in a group of tonsil-operated children. Our findings from the psychometric testing suggest that the modified Swedish version of the PHBQ-AS has good construct validity and internal consistency. The Swedish version of PHBQ-AS consists of 9 items, instead of 11 items as in the original PHBQ-AS (Jenkins et al., 2015), due to two items being excluded in the Swedish version of PHBQ (Karling et al.,
The Swedish 9-item version of PHBQ-AS cannot be compared with the original American 11-item version of PHBQ-AS. We also assume that there could be cultural differences between Sweden and the United States that also might influence items on the scale and the psychometric properties. Assessment of construct validity should include testing hypotheses that can demonstrate the proposed construct. We expected and found a positive correlation between the PHBQ-AS and the PRiC and general health, because they measure related concepts (behavior vs recovery/health), and children with behavioral changes are expected, to some extent, to have lower quality of recovery and general health. Jenkins et al. (2015) found a moderate positive correlation, $r_{0.49}$, between the PHBQ-AS and the Functional Disability Inventory (FDI). The FDI is a 15-item instrument that assesses limitations in psychosocial and physical functioning as a function of children’s physical health (Walker & Greene, 1991). In the present study we also found some positive correlations on item level between PHBQ-AS items and PRiC items. The strongest correlation was noticed between the PHBQ-AS item *Does your child make a fuss about eating?* and PRiC items *difficulty eating* ($\rho = 0.31, P = 0.000$) and *sore throat* ($\rho = 0.30, P = 0.000$). Highest frequencies of correlations were found in the two PHBQ-AS items measuring fuss about eating and poor eating. However, we strongly suggest that the results from both PHBQ-AS and PRiC should be analyzed on item level, not as total scores. The reason behind this is that we believe it is important to study each item separately when evaluating the child’s postoperative behavior and recovery. To merge all items (symptoms and signs) into a sum score can dilute or blur the results and thus diminish the external validity.

The present study also aimed to describe both post-hospitalization behavior and postoperative recovery 10 days after tonsil surgery. The results showed that 61%–98% of the children reported no symptoms in the different PRiC items and also scored general health as high. However, 39% reported a sore throat and 28% had difficulties eating on day 10 after surgery.
This is in line with other studies showing that children experienced pain up to 14 days after tonsil surgery (Stanko et al., 2013; Stewart et al., 2012). Regarding the eating factor in the behavioral changes instrument (PHBQ-AS), the parents reported that only 15% had poor appetite. One explanation for this discrepancy could be that the appetite was considered to be normal, but the pain from the sore throat made it difficult for the children to eat.

Previous research has shown that pain medications are underused in pediatric populations (Baugh et al., 2011). This underutilization can be attributed to several factors, including parental concerns. A behavioral measurement can provide information to parents about the distress and behavioral changes that children exhibit following surgery, indicative of pain. An advantage of creating a short form of PHBQ is that it would increase the utility of the tool, making it faster to complete and possibly increase compliance, with repeated use during the child’s postoperative recovery. Pain and post-operative recovery are individual and subjective experiences and should be measured with self-assessment in children, as is standard practice in adults. The PHBQ-AS could assist parents and serve as a supplement to the children’s recovery self-reports. Parents play a crucial role in pain management after hospital discharge, particularly given the increases in day surgery and brief hospitalization.

We did not find any gender differences in behavioral changes or general health, but the PRiC results revealed that girls reported more nausea, dizziness, coldness, and headache compared to the boys. No differences were found in the other 19 items of the PRiC. Gender differences reported in other studies include a higher incidence of postoperative nausea and vomiting in girls, following outpatient tonsillectomy (Sadhasivam et al., 2015), and less postoperative pain in boys (Chieng et al., 2013). A Swedish registry of 32,225 tonsil surgeries on children reported no clinically relevant difference between genders in patient-reported pain-related outcome measurements, except for days to regular food intake, which was somewhat higher in the girls after tonsillectomy. One factor was that the girls tended to be older at the time of
surgery, which could influence patient-reported outcome measures for pain (Alm et al., 2017).

One possible explanation in our study is that the girls’ symptoms were related to dehydration from the influence of diet in the postoperative recovery.

Our study showed that younger children scored lower in the item general health compared to older children. Younger children reported more dizziness and more problems going to sleep on day 10 after surgery. This is in line with other studies that have reported that younger children are at higher risk of behavioral changes after surgery (Fortier et al., 2010; Karling et al., 2007; Stargatt et al., 2006). Karling and colleagues (2007) considered that the items in the original subscale of the PHBQ better reflect behaviors in younger children. There was no difference in age in the item “sore throat” to explain untreated pain in our study. Alm and colleagues (2017) found that older children generally reported higher pain in patient-reported outcome measures. It might be speculated that older children need more support for coping with the pain and that they also are more aware that the parents are responsible for the pain treatment.

One limitation in the present study is the chosen follow-up time. The pain after tonsil surgery increases a few days after surgery before gradually decreasing, and is often most pronounced on days 3 to 5 after tonsillectomy (Ericsson, Brattwall, & Lundeberg, 2015) We might have seen a stronger correlation between behavior (PHBQ-AS) and recovery (PRI C) if data collection had been performed during that period.

**Implications for Clinical Practice and Further Research**

It has previously been shown that the family structures one-parent families (Karling et al., 2007), two or more older siblings (Stargatt et al., 2006), area of residence, and parental education (Karling et al., 2007) are risk factors for developing negative behavioral changes
postoperatively. This was not the focus of our study, but is perhaps something worth studying in the future, together with other sociodemographic factors that possibly could influence postoperative recovery and post-hospitalization behavioral changes.

This study is limited in terms of generalizability and whether the sample size is enough for a subgroup analysis of gender and age. Furthermore, this study was conducted in Swedish-speaking children and their parents. Further studies including all types of anesthesia and surgeries should be conducted, as well as studies including non-Swedish-speaking participants answering in their own languages. Another limitation to be acknowledged which may influence the results, is that we had no information about if the children had any earlier experiences of undergoing surgery or any siblings with experience of it.

The modified Swedish PHBQ-AS seems to be relevant for measuring parent-reported behavioral changes in children undergoing tonsil surgery. However, there is a difference between the child’s perspective and, for example, the health care system that defines what is good for them (Nilsson et al., 2015). Children’s own views should be considered when measuring children’s postoperative recovery and care (Bramhagen et al., 2016). Furthermore, to ensure that important and relevant outcomes are measured in clinical practice and future studies, a core outcome set developed specifically for this purpose would be highly desirable. Such a core outcome set would also help limit heterogeneity in outcome reporting. There is a lack of core outcome sets within pediatric anesthesia and surgery, both parent-reported and self-reported among children (Pearson & Hall, 2017). We therefore suggest that parent proxy PHBQ-AS reporting should be supplemented with children’s self-reported symptoms during the postoperative phase, as assessed with the PRiC (Bramhagen et al., 2016) This would identify both children with behavioral changes due to anesthesia and surgery and those children who currently experience low-quality postoperative recovery, such as girls and
younger children, as well as measure differences in behavior and postoperative recovery in clinical trials. The availability of the PHBQ-AS and the PRiC will be valuable in research and clinical practice with children experiencing pain at home following medical care.

**Conclusion**

Our findings from the psychometric testing suggest that the modified Swedish version of the PHBQ-AS has good construct validity and internal consistency, and it reflects aspects of the postoperative period measured by PRiC. Both instruments have their value and should be implemented in the postoperative follow-up. Postoperative recovery seems to differ between genders and ages, presented as lower quality of recovery in girls and younger children.

**References**


Figure 1. Graph representing the frequency of negative behavioral changes ($n = 140$) on postoperative day 10.