Paediatric Perianesthesia Questionnaire: development and data from eight hospitals across Germany

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Key points
- Patient satisfaction, as a quality indicator, is becoming a popular subject for the study.
- Authors developed a questionnaire, which was completed by >1000 children, or parents.
- ‘Privacy and waiting’, ‘information giving’, and ‘discomfort’ were the most important determinants of satisfaction/dissatisfaction.
- This novel method can be used for further research on interventions to improve patient satisfaction.

Background. Opinions about satisfaction with care are rarely obtained from children and few studies of this type exist in the area of paediatric anaesthesia. In this study, we developed a comprehensive self-administered questionnaire to measure the level of paediatric and, as a substitute in younger children, parental satisfaction with anaesthesia. In addition, we aimed to identify factors influencing satisfaction and compare results between hospitals.

Methods. We followed a rigorous protocol including construction of a pilot questionnaire and qualitative and quantitative analysis. The questionnaire was adapted for confounding variables. We analysed satisfied and dissatisfied groups and compared satisfaction scores between participating hospitals.

Results. A questionnaire was developed which comprised 37 questions assessed on a five-point Likert scale. With a response rate of 71%, a total of 1052 patients completed the questionnaire. In the final analysis, 760 questionnaires (72%) were included. Most questionnaires were answered by the parents [705 (92.8%)]. The mean age of children was 6.7 (4.97) yr. Multivariate analysis found a history of previous anaesthetic problems and the identity of the person answering the questionnaire as influencing factors on the sum score. The most important differences between satisfied and dissatisfied children were found for the dimensions ‘privacy and waiting’, ‘information giving’, and ‘discomfort’. Scores differed between hospitals.

Conclusions. Our psychometric questionnaire provides a novel approach to paediatric patient satisfaction with anaesthesia care and covers areas deemed important by children, parents, and carers. Significant differences between satisfied and dissatisfied groups and between participating hospitals were found.

Keywords: audit; measurement techniques; outcome; paediatric anaesthesia; patient satisfaction; surgery
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Research investigating children’s satisfaction with anaesthesia care is scarce, despite the increasing awareness and growing discussion regarding the rights of children to participate in research and make decisions about their own healthcare.1

Increasing competition in the healthcare marketplace has fuelled the drive towards increased use of questionnaires to measure patient satisfaction.2 Their quality depends largely on construction, validation, and sampling.3 A variety of instruments have been developed for adults over the last few years, some adhere to psychometric protocols and take some of the complexities of healthcare into account.2 4–7 The multidimensional nature of satisfaction still limits the development of questionnaires.

Assessing children’s experiences with anaesthesia care is even more complex. Answering a questionnaire requires explicit recall, which in turn requires explicit memory which children begin to develop at around 3 yr of age.8 Parental opinions of satisfaction with care have previously been used as a substitute for opinions from children and adolescents.

The simplicity of some existing instruments limits the identification of all aspects of satisfaction,9 other studies have focused on general aspects of care10 or on certain aspects of the anaesthetic experience.11 12

The purpose of this descriptive comparative survey was to construct a self-administered questionnaire to measure paediatric patient satisfaction in conjunction with all stakeholders that can be answered by older children, or parents.
in conjunction with younger children. In addition, we compared results from the questionnaire between different hospitals.

Methods
The study was approved by the Institutional Research Ethics Committee. Written informed consent was obtained from parents but requirements for written consent in children was waived, the questionnaire had to be handed from the parent/legal guardian to the child. Data were gathered from eight anaesthetic departments across Germany. A, university hospital (1650 beds); B, tertiary hospital (1000 beds); C, university hospital (1200 beds); D, tertiary hospital (940 beds); E, tertiary hospital (1440 beds); F, tertiary hospital (1400 beds); G, primary hospital (355 beds); and H, secondary hospital (556 beds). For the initial development of the questionnaire, patients at hospital A were recruited.

Inclusion criteria were age <16 yr (or any age when treated within paediatric departments), ability to speak (read, write) and understand German, and elective procedures under general or regional anaesthesia.

A number of general questions were also included in the questionnaire. Visual analogue scales (VAS) were used to rate general treatment by the surgical and anaesthetic departments.

The development of the questionnaire followed steps of a psychometric protocol\(^{13}\) and statistical evaluation\(^{14, 15}\) as follows.

Items
A literature review using MedLine was supplemented by semi-structured interviews with patient families and one-to-one interviews with older children and healthcare professionals to identify an initial set of items. All interviews and the comprehension probing were conducted by an interviewer trained in relevant interview techniques and with experience from previous studies.\(^{7}\) Answers were transcribed and tape recorded by a second person. Interviews were conducted until no new ideas emerged from the analysis. Families were selected for the interviews and the ‘comprehension probing’ with the help of the ward nurses who indicated which families would be most likely to participate. It was not intended to interview a representative sample; instead, we wanted to poll typical test persons to generate a theoretical sample.\(^{16}\)

Items were worded into questions to contain only single ideas; some had to be phrased into several questions. Questions were designed to be non-biased\(^{17, 18}\) and answered on a five-point Likert scale (4, strongly agree; 3, agree; 2, neither agree nor disagree (neutral); 1, disagree; and 0, strongly disagree). All questions were arranged in the chronological order. The literacy standard was set to fourth-grade reading level using the ‘fog index’ (Microsoft\(^{19}\)).

The word ‘satisfaction’ was avoided and questions were phrased to detect higher levels of dissatisfaction.\(^{7}\)

In addition to the initial questionnaire, a small number of participants were asked to answer a set of 11 probing questions, for example, investigated words and expressions (Please tell me, ... what does the word concern mean to you?), fixed periods (... whether the consultation with the anaesthetist happened before or after the procedure?), or feelings (... what happens to you if you feel cold or freezing?) and the interviewer referred to the corresponding questions in the questionnaire. At the end, the interviewer asked whether any questions were difficult to understand, and these were discussed on a needs basis. This ‘comprehension probing’ was designed to assess whether the meaning or subjects of the questions were understood.

This was followed by an interim analysis of reliability and validity.\(^{14, 19}\) With each step of the construction (i.e. at the end of the interviews and with the initial questionnaire before the probing questions were given), items were ranked on a four-point Likert scale with 0 = unimportant to me to 3 = very important to me by the participant, mostly children and parents in unison. After each step, an expert group (consisting of one psychologist, one German philologist, and three anaesthetists) reviewed each item to ensure that no important items were eliminated.

Parents were instructed to ask the questions in a neutral tone if they administered the Paediatric Perianesthesia Questionnaire (PPQ) to the child.

Results were analysed to ensure that the questionnaire is a valid and reliable measure of patient’s experiences. For the analysis, questionnaires with missing items were filtered to allow a maximum number to be analysed. For analysis of the scores, questionnaires with less than 20% missing items were included, and missing values were replaced by mean values.\(^{4, 20}\) Before analysis, negative items were reversed, and scores were transformed to a 0–100 scale, high scores indicate a high level of satisfaction or approval.

Dimensions
Before the exploratory principal component analysis (PCA), the Kaiser–Meyer–Olkin (KMO) measure was obtained with a value above 0.5, indicating that distinct and reliable dimensions are produced by factor analysis. The Bartlett’s test of sphericity was obtained to test the variables in the population correlation matrix, its significance indicating a non-correlation matrix, thus suitability for a PCA. The measure of sampling adequacy (MSA) was obtained for each item with values exceeding 0.5 to ensure that the variables sufficiently correlated with one another.\(^{21, 22}\) Factor analysis with PCA, correlation matrix, scree plot for multiple factors, and varimax rotation\(^{23}\) was used to detect the number of dimensions.

Validity
After the study protocol allowed to achieve content validity, item-discriminant validity (IDV) was assessed for the extent to which items correlated with dimensions they were not hypothesized to represent. Items should have a higher correlation with their own dimension than with other dimensions.
and inter-item correlation (IIC) should be above 0.40. External validity was tested by correlations between scores and the VAS (convergent validity). Discriminant validity was determined by using either dimension mean scores across patient groups differing in socio-demographic rating or clinical features (surgical grades, etc.) after the multivariate analysis.

Reliability
Item-dimension correlations (Cronbach’s α) were calculated for item internal consistency, with 0.61–0.80 representing a substantial correlation, and from 0.81 to 1.00 a good correlation. Item-dimension correlations were adjusted for difficulty and questions with skewed values were discussed, changed, or deleted.

Confounding variables
The effects of different variables on the questionnaire scores were determined by univariate analysis, followed by multivariate and a multiple linear regression analysis (forward stepwise) method. Variables were integrated in the next step with P<0.1. Scores among patient groups that differed significantly in the multivariate analysis were subject to T-transformation. Adjustment was allowed for the strongest confounding variables (P<0.05) until no shift of the mean >5% was found. Dichotomous variables were considered first; continuous variables were grouped. After T-transformation, satisfaction was considered one standard deviation (SD) above the mean, and dissatisfaction was considered below the mean. The remainder were not assigned to any group. Comparisons were made between hospitals and the pooled data from all participating hospitals.

For statistical analysis, SPSS (SPSS 14.0, SPSS Inc., Chicago, IL, USA) and Microsoft Excel were utilized. For ordinal data and scores, non-parametric tests were applied. Continuous and ordinal data were compared between groups using Wilcoxon’s ranked-sum test or the Kruskal–Wallis test, respectively. Categorical data were tested between groups using Fisher’s exact test. Correlations were made by Pearson’s correlation coefficients (r). A value of P<0.05 was considered statistically significant unless indicated.

Results
Items
Interviews with 12 families and 21 one-to-one interviews were conducted and 75 anaesthesia-related items were identified. Of these, 23 covered the pre-anaesthetic consultation, 15 the time before the procedure, 12 the anaesthesia, 24 the emergence and the recovery period, and six miscellaneous topics. After items were discussed among the expert committee and the healthcare professionals who had been interviewed, 37 items were worded into questions forming the pilot questionnaire. The six-page questionnaire was designed with an extra page that can be folded and fixed around the questionnaire to provide an opaque envelope. The questionnaire was returned by post or collected by a research assistant.

Additional probing questions were answered by 19 children and parents; only two parents refused due to time constraints. Potential misunderstandings were found for two questions which were reworded.

Patients received the questionnaire between 6 and 48 h after returning to the ward and before they were discharged home (see Supplementary material).

Patient characteristics
With a response rate of 71%, a total of 1052 patients completed the questionnaire, of which 760 (62%) were included in the final analysis of the scores.

Of the 760 questionnaires finally analysed for satisfaction and dissatisfaction ratings, the vast majority were answered by one of the parents [mother 537 (70.7%), father 168 (22.1%)] and 41 (5.4%) by the child. These children were older (14.8 yr; SD 2.73; range: 7–19 yr) than the average [6.7 yr (SD 4.97; range: 0–20 yr)]. Overall, 59 (7.8%) were 1 yr or younger at the time of the study, 27 children were older than 16 yr, and 471 of the children (62%) were males. These figures were not different from the patient characteristics of the overall answering patient population.

The children underwent a range of surgical procedures, with surgical grades24 being: 1, minor in 278 (36.6%); 2, intermediate in 392 (51.6%); 3, major in 62 (8.2%); and 4, major in 26 (3.4%) of the cases.

A total of 362 (47.6%) had previous operations which were classified as minor or intermediate in 288 (79.6%) of cases. Of these, 232 (65%) reported positive memories of their last operation and 42 (11.6%) reported problems with previous anaesthesia. To ensure that the rating given by our paediatric patients and parents reflect the magnitude of the operation, we correlated the clinical and the subjective patient ratings for previous and current operation (r > 0.9, P<0.001).

Only 65 (8.6%) children were living with a single adult, whereas in 107 (14.1%) of the cases, parents were separated. Five hundred and twenty (68%) had siblings.

Dimensions
The KMO measure for the total questionnaire was 0.79 and the MSA was >0.5 for all items in the final questionnaire. The Bartlett test of sphericity was P<0.001.

PCA identified five dimensions (factors) to which every question could be assigned. The total explained variance with this model was 48% (Table 1).

Some of the questions only applied if a problem has occurred [D1 (treatment of discomfort) and D5 (treatment of pain)]; thus, they were only answered by the affected population. We therefore based the analysis of satisfaction and dissatisfaction on the remaining 26 questions, without the dimensions for treatment (D1 and D5), whereas all other analyses allowed for these dimensions as well. This abbreviated score is referred to as the core sum score (CSS), whereas the score including the treatment is referred to as the total sum score (TSS).
The TSS and the CSS correlated with the VAS treatment by anaesthesia ($r=0.55$ and $0.6; P<0.001$), whereas a less marked correlation was found with the VAS for the treatment by surgery (0.3 and 0.35, $P=0.02$). Although all dimensions correlated to the TSS ($r=0.51–0.88$; all $P<0.001$), the CSS correlated strongly to its subscores D2–D4 (0.74–0.81; all $P<0.001$), but hardly to the dimensions assessing for treatment (D1 and D5, $r=0.19$ and 0.16, $P=0.05$).

Inter-dimension correlations indicated independency of the dimensions (all $r<0.3$ apart from D1 and D5 ($r=0.53$, $P<0.001$)). Other values for validity are presented in Table 2.

### Reliability

Internal consistency was demonstrated by the Cronbach’s $\alpha$ for the sum score and the five dimensions (Table 2).

### Multifactor analysis for CSS, TSS, and the subscores

The TSS and CSS both were independently associated with the experience of previous anaesthetic problems ($P=0.005$) and the person answering the questionnaire ($P=0.01$). Dimension 1 (treatment of discomfort) was influenced by the grade of the surgical procedure ($P=0.008$), the person answering the questionnaire ($P=0.001$), and the number of adults living with the child ($P=0.01$). All other scores were not altered by possible confounding factors after the multivariable analysis.

The TSS and CSS were adjusted for the previous anaesthetic problems; however, adjusting for the person answering the questionnaire did not modify the adjusted results any further.

### Satisfaction and dissatisfaction

Scores were transformed to a 0–100 scale, with 100 indicating the highest level of satisfaction (Table 2).

After T-transformation, the satisfied patients ($z$-value $\geq 1$) scored significantly different compared with the dissatisfied group of ($z$-value $\leq 0$) in all dimensions (Fig. 1).

The largest differences between the satisfied and dissatisfied groups were found for dimensions D4 (discomfort), D3 (information giving) followed by D2 (privacy/waiting). Pain (in recovery and more so on the ward), and recovery after anaesthesia, was identified as a problem for the discomfort dimension. Waiting, privacy, response to the needs/wants of parents/children in the recovery room, reassurance by the anaesthetist, the time that parents were allowed to stay on induction of anaesthesia, the information given, and the impression that the anaesthetist was under time pressure during the consult were all identified as problems in other areas. Subgroup analysis of cases where parents not allowed to stay long enough on induction of anaesthesia (question 12, $n=135, 18\%$) revealed that none of these 135 parents had been allowed to stay until after induction of anaesthesia.

If given the choice, 19.1% of the dissatisfied group would not choose the hospital and 26.3% the anaesthetic department again or were indifferent. In the satisfied group, all would choose the same hospital or anaesthetic department again ($P<0.001, 3.6\%$ indifferent).

Although there was no difference between scores for adults and children, children rated the reassurance during the first contact with the anaesthetist and anaesthetic assistant (q 10 and 11) significantly higher than parents.
Comparing hospitals

Differences in satisfaction were compared between the hospitals and the pooled data from all hospitals (Fig. 2). In comparison, Hospital A scored significantly lower, whereas D, E, and H scored higher than the pooled average. After T-transformation, the proportion of satisfied and dissatisfied gives a slightly different picture (Fig. 3), where E and H no longer display a higher percentage of satisfied patients.

Table 2

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Items</th>
<th>α</th>
<th>n</th>
<th>IIC</th>
<th>IDV</th>
<th>Score [mean (SD)]</th>
<th>Score points</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSS Core sum score</td>
<td>26</td>
<td>0.847</td>
<td>760</td>
<td>i</td>
<td></td>
<td>73.1 (10.5)</td>
<td>76 [69–83 (43–104)]</td>
</tr>
<tr>
<td>TSS Total sum score</td>
<td>37</td>
<td>0.868</td>
<td>446</td>
<td>i</td>
<td></td>
<td>68 (9.6)</td>
<td>100 [91–108 (63–148)]</td>
</tr>
<tr>
<td>D1 Treatment of discomfort</td>
<td>7</td>
<td>0.896</td>
<td>466</td>
<td>0.79–0.81*</td>
<td>0–0.49*</td>
<td>49.4 (19.1)</td>
<td>14 [12–15 (0–28)]</td>
</tr>
<tr>
<td>D2 Privacy/waiting</td>
<td>10</td>
<td>0.763</td>
<td>847</td>
<td>0.43–0.73*</td>
<td>0–0.46*</td>
<td>71.7 (14.1)</td>
<td>29 [26–32 (10–41)]</td>
</tr>
<tr>
<td>D3 Information giving</td>
<td>7</td>
<td>0.825</td>
<td>1011</td>
<td>0.6*-0.82*</td>
<td>0–0.45*</td>
<td>75.2 (14.2)</td>
<td>21 [19–24 (4–28)]</td>
</tr>
<tr>
<td>D4 Discomfort</td>
<td>9</td>
<td>0.738</td>
<td>844</td>
<td>0.41–0.61*</td>
<td>0–0.32*</td>
<td>72.9 (14)</td>
<td>27 [23–29 (1–36)]</td>
</tr>
<tr>
<td>D5 Treatment pain</td>
<td>4</td>
<td>0.819</td>
<td>669</td>
<td>0.67–0.82*</td>
<td>0–0.47*</td>
<td>65.4 (20.5)</td>
<td>10 [8–12 (0–16)]</td>
</tr>
</tbody>
</table>

[mean (SD), 2.7 (1) vs 3.1 (0.9) and 2.8 (0.96) vs 3.1 (0.86); P=0.002 and 0.01], while no other questions showed any difference.

Fig 1

Dimensions (D1, treatment; D2, privacy and waiting; D3, information giving; D4, discomfort; D5, treatment of pain) and the TSS and CSS for dissatisfied and satisfied patients assessed using the questionnaire after T-transformation for satisfied patients (z-value ≥ 1) and more dissatisfied patients (z-value ≤ 0). Boxes and whiskers are inter-quartile range (IQR) and 95% CI, respectively; the bar is the median and dots represent extreme values. ***P<0.001.

Discussion

Children are intelligent, capable people, and should be allowed to participate in healthcare decision-making appropriate to their level of development. Our PPQ puts emphasis on concerns surrounding paediatric anaesthesia. We believe that the methods used to develop the protocol were rigorous and that we have developed a reliable and valid instrument.
The questions in the final questionnaire allow a detailed view upon the relevant domains of satisfaction with each of the five dimensions correlating and contributing to the TSS. The low IDV and high IIC should allow analysis of the cause of dissatisfaction and prove validity. The Cronbach’s α from this large sample was >0.7 for all scores, while item IIC r>0.4 support item internal consistency and reliability.

Re-testing is not recommended for instruments measuring patient satisfaction; it is assumed that during the

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**Fig 2** CSS for participating hospitals in comparison with the accumulated data (all). Boxes and whiskers are IQR and 95% CI, respectively; the bar is the median and dots represent extreme values. **P ≤ 0.01, ***P ≤ 0.001.

**Fig 3** Proportion of satisfied, intermediate, and dissatisfied patients assessed using the questionnaire in hospitals after T-transformation in relation to the accumulated data (all). **P ≤ 0.01, ***P ≤ 0.001.
recommended waiting period re-tests might be affected by memory or events.\textsuperscript{3}

Our response rate of 71\% was lower than in a previous study\textsuperscript{7} but was higher than response rates resulting from postal distribution.\textsuperscript{6} The number of questionnaires with more than 20\% missing items was higher than in our previous study on adults and in other studies.\textsuperscript{7,9} We aimed to develop a comprehensive questionnaire instead of assessing satisfaction by means of a few, simple questions.\textsuperscript{9}

The resulting complexity of our questionnaire may have contributed to the decreased response rate and increased incidence of incomplete questionnaires. We have no way to exclude refusal bias, but this is common to similar studies.

Our instrument was not designed to be specifically answered by children alone and only a small fraction of the questionnaires were answered by children. These reached scores similar to the parent group. However, this does not indicate that children judge their treatment in the same way as adults do. Yet, research is lacking to answer questions whether parents truly capture and accurately represent children’s and teens’ satisfaction with healthcare.

Answering a questionnaire requires explicit recall and memory and children are also highly suggestive, especially at younger age. Careful questioning is required\textsuperscript{8} and questions have to be designed to match the cognitive and emotional level. Social desirability and observer bias might also distort results.\textsuperscript{5} To reduce bias, parents were asked to adhere to certain rules, that is, using a neutral tone when asking.\textsuperscript{17,18} We avoided questions with only two responses which are particularly likely to lead to guessing or suggested answers and put the questions into a context to have contextual meaning for the child since children are also more likely to encode and retrieve memories that have meaning or importance for them.\textsuperscript{17}

Families desire healthcare that reduces children’s physical stressors such as pain or discomfort, psychological stressors such as inadequate information or lack of control, and environmental stressors such as unfamiliar surroundings or people.\textsuperscript{10,26} Being included in decisions about care is valued highly by patients.\textsuperscript{27,28} The satisfied and dissatisfied groups differed most in the dimensions ‘privacy/waiting’ and ‘information giving’ and less so in the treatment categories. The importance of providing information is highlighted by our findings.\textsuperscript{4,6} The parental presence on induction of anaesthesia has been found important to both parents\textsuperscript{29} and children.\textsuperscript{9} We found that the proportion of patients who were unhappy with this process did not get the chance to stay until after induction.

We aimed to reduce ‘contamination’ of the main variables by adjusting the scores for confounding variables after the multivariate analysis. Nevertheless, transforming the results gives an approximation of the proportion of patients considered to be dissatisfied or satisfied, but no absolute statement. Families where the child had no problems with previous anaesthesia and where a person other than the child’s mother answered seemed to score higher, a finding that has not been reported previously, whereas neither (child’s) gender nor (child’s or parent’s) age exerted influence on the scores.

To the best of our knowledge, this is the first study on pediatric patient satisfaction with anaesthesia care using a multidimensional, validated questionnaire.

Although our comparison between hospitals is limited by the different numbers of questionnaires obtained from each hospital, all contributed to the available information.

After passing through several phases, the PPQ can now be considered reliable and valid, although the task is ongoing.\textsuperscript{30} Some limitations of the PPQ arise from its complexity. Future projects may aim to reduce its complexity and could cross-validate the questionnaire with instruments devoted to other aspects such as fear and social desirability to improve its performance. The PPQ seems to be easy to apply in the clinical setting, covers a range of potential confounders, and adds relevant information to the routine data collected in the course of anaesthetic treatment.

**Supplementary material**

Supplementary material is available at British Journal of Anaesthesia online.

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**Conflict of interest**

None declared.

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