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Original article

Reliability and validity of the Dutch version of the Parents' Postoperative Pain Measure (PPPM-Dv)

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Abstract

Background: **Pain is often poorly managed in pediatric daycare surgery. The Parents' Postoperative Pain Measure (PPPM) is available as parent report to rate children's pain at home after surgery and is a reliable and well validated tool.**
Objectives: **To establish the reliability and validity of the Dutch version of the Parents' Postoperative Pain Measure (PPPM-Dv) to assess postoperative pain among children aged between 2 and 12 years during five postoperative days at home.**
Design: **cross-sectional cohort study.**
Setting: **ZNA Queen Paola's Children's Hospital.**
Methods: **120 children were included. Stratification was done according to age (2-5 and 6-12 years) and three surgical categories. Parents socioeconomic status (SES) and religion were registered. For all children, parents recorded pain using the PPPM-Dv and Numerical Rating Scale (NRS-11) twice daily for five days. Children between 6-12 years were asked to rate their experienced pain using the Faces Pain Scale-Revised (FPS-R).**
Results: **From 120 children included 91 (76.6%) families completed pain diaries. Reliability across the five-day postoperative period, Cronbach's α for PPPM-Dv was .70 to .90. Correlations between PPPM-Dv and NRS-11/FPS-R were strong (.81 and .61). Using NRS-11(≥4) as binary classifier (yes/no), ROC analysis identified a PPPM-Dv score >2 as cut-off, with a sensitivity of 89% and specificity of 82%. With FPS-R (≥4) as binary classifier (yes/no), ROC analysis identified a PPPM-Dv score >2 as cut-off (sensitivity:88%; specificity:79%). PPPM-Dv scores decreased over time and followed a similar pattern as the NRS-11 and FPS-R scores. Generalized Estimation Equations (GEE) showed that higher PPPM-Dv scores were associated with a more painful surgical category and were independent of SES and religious affiliation.**
Conclusion: **These data provide evidence for the reliability and validity of the PPPM-Dv. This can be a helpful tool to identify pain in children after daycare surgery at home in a Dutch speaking population.**
Trial registration: **https://doi.org/10.1186/ISRCTN12813822**

Keywords: **Pediatric, postoperative pain, reliability, validity.**

This stratified cross sectional cohort study was conducted at the ZNA Queen Paola's Children's Hospital in Antwerp, Belgium from 09/03/2021 until 30/05/2022 and was approved by the Institutional Review Board on 08/07/2020 (ZNA/OCMW Antwerp, ref: 009;OG 031; E.C. 5394, ZNA Queen Paola's Children's Hospital, Lindendreef 1, 2020 Antwerp, chairman: De Deyn P. P. MD PhD). It was conducted in accordance with the Declaration of Helsinki, the APA ethical standards and reported following STROBE statement of observational studies. The study is registered at: https://doi.org/10.1186/ISRCTN12813822 Informed consent was obtained by a research nurse on the day of surgery.

Introduction

Pediatric surgery under anesthesia is often performed on a day-case basis. This approach has a lot of advantages for both the child and parents such as less disruption of family life and lower healthcare costs. The main drawback is the unidentified presence of significant postoperative pain after day-case surgery in up to 80% of children in their home environment[1,2,3,4,5].

Good pain management proves to be a very complex issue and parents have become important partners in postoperative care at home[4,6,7]. Parents tend to undertreat their child's postoperative pain and the reasons why remain unclear. Several predictors could be withheld such as parental personality, parental anxiety, parental level of education, cultural/religious reasons and parental misconceptions about pain medication[2,8,9,10].

There seems to be a discrepancy between high postoperative pain ratings reported by the parents and the low doses of analgesics administered. This may indicate that parents have no trouble recognizing and assessing their child's pain but may struggle to manage it effectively[4,5,7,11].

A cornerstone in pain management is the availability of a reliable and valid pain assessment tool. Therefore, it is essential to adopt a valid, reliable measure for the child's pain that can easily be used by parents at home in a Dutch speaking population. The English Parents' Postoperative Pain Measure (PPPM) is a 15-item questionnaire specifically designed for parents to assess their child's behavior changes and verbal pain behavior at home after surgery. The PPPM was preliminary validated for children aged between 7-12 years by Chambers et al.[10,12] It showed good reliability, good convergent validity with child-related pain and no significant interactions were found between child age and gender. PPPM scores also followed the pattern of children's self-reported pain intensity but it was not related to situational anxiety[13].

The reliability and validity of the PPPM was extended to 2-6 year old children showing good internal consistency and good correlations between the PPPM scores and parental global pain ratings in young children (<6 years).10 Reliability and construct validity is now established beyond fourteen days postoperatively[14].

Furthermore, the PPPM is a proposed tool by core outcome domains and measures for pediatric acute and chronic/recurrent pain clinical trial (PedIMMPACT) recommendations and has been used in several studies[11,15-17]. The PPPM has been translated and validated in several languages and it is essential to use a standard forward-back-forward translation technique[18-20].

The aim of the present study is to assess the reliability and validity of a Dutch translation of the Parents' Postoperative Pain Measure (PPPM-Dv) among children aged between 2 and 12 years, up to five days postoperatively. Additionally, this study will examine the potential association between the PPPM-Dv and two factors: the socioeconomic status (SES) and the religious beliefs of the parents.

Methods

This stratified cross sectional cohort study was conducted at the ZNA Queen Paola's Children's Hospital in Antwerp, Belgium from 09/03/2021 until 30/05/2022 and was approved by the Institutional Review Board on 08/07/2020 (ZNA/OCMW Antwerpen, ref: 009;OG 031; E.C. 5394, ZNA Queen Paola's Children's Hospital, Lindendreef 1, 2020 Antwerp, chairman: De Deyn P. P. MD PhD). It was conducted in accordance with the Declaration of Helsinki, the APA ethical standards and reported following STROBE statement of observational studies. The study is registered at: https://doi.org/10.1186/ISRCTN12813822

Inclusion and exclusion criteria

Children aged between 2-12 years undergoing daycare surgery were considered eligible if they met the following criteria: 1. American Society of Anesthesiologists (ASA) physical status I or II; 2. written informed consent of parents and an assent form explained to the child aged 6 – 12 years; 3. parents with a good understanding of the Dutch language; 4. one accompanying parent at induction of anesthesia; 5. no premedication; 6. as surgical procedures: a) inguinal hernia repair, myringotomy, adenoidectomy, gastroscopy, dental surgery; b) orchidopexy, strabismus, circumcision; c) adenotonsillectomy, orthopedic osteosyntheses.

Children with a known mental/cognitive retardation were excluded.

Stratification was used to allocate the children in subgroups based on: 1) child's age - age groups between 2-5 and 6-12 years; 2) distribution into three groups of surgery and their expected related pain intensity at home: a) mild pain – inguinal hernia repair, myringotomy, adenoidectomy, gastroscopy, dental surgery; b) moderate pain – orchidopexy, strabismus, circumcision; c) severe pain – adenotonsillectomy, orthopedic osteosyntheses[16,21].

Parents received information at the preoperative surgery consultation and informed consent was obtained by a research nurse on the day of surgery.

All children and parents received a standard psychological preparation including an informative preoperative video as well as an information

brochure on postoperative pain management at home.

Anesthesia procedure

The anesthetic procedure was left to the discretion of the anesthesiologist.

Pain management at home

Parents received standardized written pain management instructions for their child at home. Basic regimen consisted of paracetamol (syrup 15mg/kg four times a day) and if appropriate oral ibuprofen (syrup 5mg/kg four times a day) was added. Parents were instructed to strictly adhere to the prescribed regimen for up to five days.

Assessments

Demographic and medical data

On the day of admission, a research nurse collected demographic/medical data. The parents' level of education classified as: 1. no education/primary school; 2. high school; 3. further studies/university, was used as an indicator for SES. Also, the parents' religious conviction was noted.

Parents' Postoperative Pain Measure

The PPPM is a 15-item behavioral measure which assesses the child's postoperative pain at home after surgery[10,12]. Each question can be answered by using a simple yes or no and the score ranges from 0 to 15. A PPPM score ≥ 6 is defined as a child with clinically significant pain which should be treated. The PPPM has initially been validated for children aged 7-12 years. Previous research showed that reliability (i.e. internal consistency) was good (Cronbach's α between .87 – .88). The convergent validity with child-related Faces Pain Scale (FPS) on days 1 - 2 after surgery were also good: coefficient r =.60.22 A positive correlation between the PPPM and the child's emotional distress after surgery (day 1: r =.39; day 2: r =.27) was found. No significant interactions have been found with the child's age and sex. Child-rated pain decreased from day 1 to day 2 and the same pattern was found for the PPPM. The discriminative validity of the PPPM to distinguish between children who underwent no/low pain surgery or moderate to high pain surgery was good and a cut-off PPPM score ≥6 showed good sensitivity and specificity of respectively 88 and 80% for day 1 and 80 and 84% for day 2 respectively.

The reliability and validity of the PPPM was extended to 2 – 6 year old children showing good internal consistency (Cronbach's α between .81 – .88) and good correlations between the PPPM scores and both the child-rated FPS in children ≥6 years (day 1: r =.64; day 2: r =.53) and the parental global pain ratings using a FPS in young children (<6 years) (day 1: r =.72; day 2: r =.62).10

Translation process of the PPPM-Dv

With approval of C. Chambers, the original version of the PPPM was translated using standard forward-back-forward translation technique which was done by two independent professional translators.12, 23 This was followed by an evaluation of the translation by an expert panel of two psychologists and two anesthesiologists. For the definitive consensus translation: see Appendix 1.

Translation process of the PPPM-Dv

Parents were asked to assess the child's global pain at home by using an NRS-11 – 'how much pain do you think your child feels right now?' – score range 0-10 and NRS-11 scores < 4 indicate no or mild pain; scores ≥4 indicate moderate to serious pain. The endpoints of the scale represent the extremes of pain experience (0 = no pain to 10 = worst possible pain). An NRS-11 was used in several studies and gives a global impression of the child's pain[21,24].

The accompanying parents were asked to score their child's pain using the NRS-11 at the same time they completed the PPPM-Dv during five consecutive postoperative days.

Finally, the parents were asked to send the diaries back by using a self-addressed stamped provided envelope. Telephone calls were made by a research nurse on the first and fifth postoperative day to the parents.

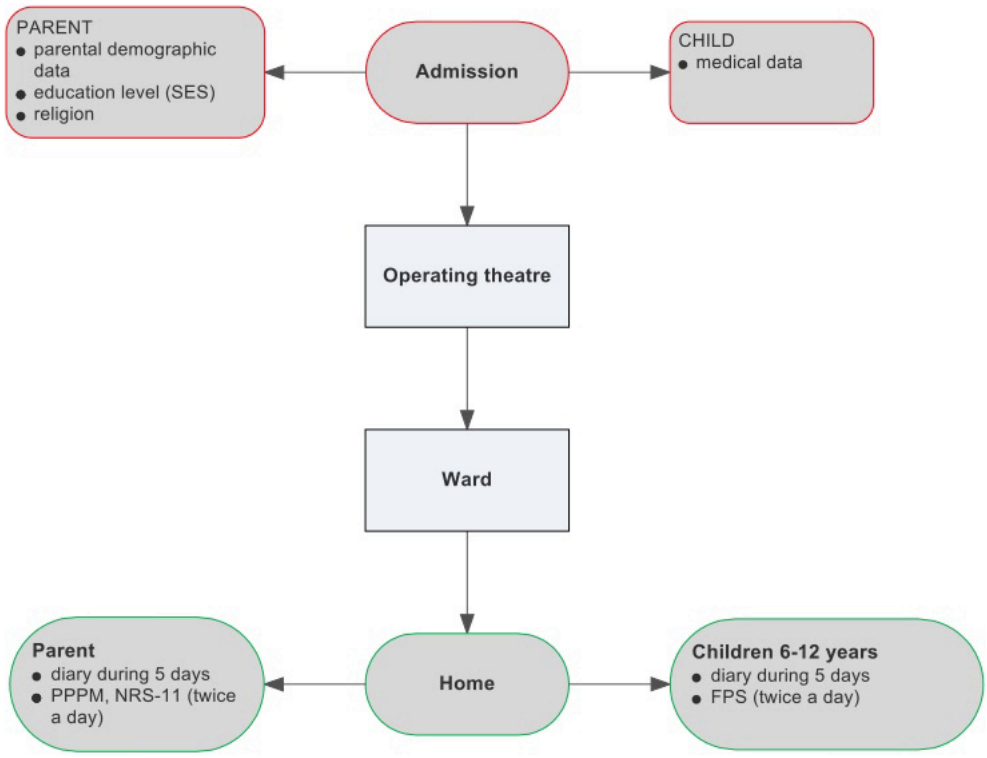
Childrens' assessment tool

The Faces Pain Scale-Revised (FPS-R) in children aged 6 – 12 years

The FPS-R was developed as a self-report measure of pain intensity for children. It is the recommended tool by the International Association for the Study of Pain (IASP) (www.iasp-pain.org/Education/Content.aspx). The validity of the FPS-R has been supported by strong positive correlations with a Visual Analogue Scale (VAS) (r =.92) and the Colored Analogue Scale (CAS) (r =.84)[25,26].

For research the FPS-R is the recommended tool based on the psychometric feature and is ease of use[26,27]. The absence of smiles and tears in this scale may be advantageous.

Instructions to use the Dutch version were downloaded from www.iasp-pain.org. Score ranges



SES, socio-economic status based on education level (1. no education/primary school; 2. high school; 3. further studies/university); PPPM-Dv, Parents Postoperative Pain Measure – Dutch version; NRS-11, Numerical Rating Scale; FPS-R, Faces Pain Scale – revised.

Fig. 1 — Flowchart diagram of the study.

from 0 – 10 (0 = no pain to 10 = very much pain) with a treatment cut-off of ≥4. Children were instructed/trained to use the FPS-R and were asked to fill in a diary two times each day (after breakfast and in the evening after dinner) during five postoperative days.

Statistical analysis

Cronbach's α reflects the interrelationship between items in a questionnaire. Sample size calculation was based on the Cronbach's α for the analysis of internal consistency and reliability. Bonett's formula was used for this calculation[28]. By assuming a minimum acceptable level Cronbach's α .7 (H0), an expected Cronbach's α of .8 (H1) 10, significance level (α) .05 (two-tailed), power (1 - β) = 80%; 15 items (k) and an attrition rate of 10%, we calculated a sample size of 104 or a sample size with ± 15% dropout = 120 children to be included.

Demographic and psychometric data of children and parents will be presented as means ± SD (continuous data) or median with IQR or as percentages for categorical data. Normal distribution will be checked by Kolmogorov-Smirnov and Shapiro-Wilk tests.

Reliability

Internal consistency reliability of the PPPM-Dv is assessed using the Cronbach's α on five consecutive postoperative days, with a score above .70 indicating a high level of reliability.

Validity

1. Convergent validity of the PPPM-Dv involves comparing the PPPM-Dv with an existing valid assessment tool. Therefore, Pearson's correlation coefficients and two-tailed test are used between PPPM-Dv, NRS-11 and FPS-R. According to Cohen's criteria 29 correlations of .10 – .29 are considered small, .30 – .49 medium and >.50 as large.
2. Sensitivity to expected lower scores of the PPPM-Dv during the five postoperative days will be analyzed using Friedman ANOVA in comparison with the change of NRS-11 and FPS-R scores.
3. Cut-off scores on the PPPM-Dv were compared with different cut-off values on the NRS-11 (≥4) and FPS-R (≥4). Therefore, receiver operating characteristic (ROC) curves were calculated to determine an optimal cut-off value for the PPPM-Dv with the NRS-11 (≥4) as binary classifier (yes/no) and the FPS-R ≥4 as binary classifier (yes/no). The maximum value of the Youden J-statistic for the ROC curve, i.e. sensitivity+(specificity-1), may be used as a criterion for selecting the optimum cut-off point for the PPPM-Dv.

4. Construct validity is considered as the extent to which an instrument measures the construct it is designed to measure. Based on literature we studied construct validity of the PPPM-Dv by assessing three kinds of surgeries and their expected postoperative pain levels in the home environment[16,21]. Accordingly, three subgroups of surgical interventions were created with following expected pain levels: 1. no/mild pain; 2. moderate pain; 3. severe pain. Multiple Bonferroni corrected Mann-Whitney U-tests were performed between these three surgical subgroups.

5. Finally, generalized estimating equations (GEE) were performed with as independent covariables: a) child age and gender; b) parental gender; c) surgical categories 1, 2, 3; d) level of SES (education level I, II, III); e) parental religious conviction (c, d, e were recoded into dummy variables) and the PPPM-Dv as dependent variable. GEE is a statistical method that is robust to non-normal distribution and missing data. It can explore the associations between PPPM-Dv scores over time and with individual- level covariables.

P-values of <.05 were considered statistically significant.

All data were analyzed using IBM SPSS Statistics for Windows, Version 28.0 Armonk, NY: IBM Corp and MedCalc Statistical Software version 20.009 (MedCalc Software Ltd, Ostend, Belgium; https://www.medcalc.org; 2021).

Results

A total of 308 parents were screened for eligibility between March 2021 and May 2022. Of these 128 were excluded because of insufficient knowledge of Dutch, 27 parents were excluded on practical grounds (logistics) and another 25 parents on emotional grounds (refused to participate). Four children had a known mental retardation and 4 were diagnosed with autism. Of the final 120 parents included, 29 did not return any questionnaires. A final sample of 91 parents could be analyzed (Figure 2).

The characteristics of children and accompanying parents are presented in Table I. Of the accompanying parents 72 (79.1%) were mothers and the children's mean age was 5.2 ± 2.6 SD. The numbers of patients undergoing surgical procedures were in category 1: inguinal hernia repair (n=3), myringotomy (n=9), adenoidectomy (n=11), gastroscopy (n=2), dental surgery (n=15); category 2: orchidopexy (n=5), circumcision (n=21); category 3: adenotonsillectomy (n=23), orthopedic osteosyntheses (n=2).

Reliability

Internal consistency of the PPPM-Dv was high on the day of surgery. Cronbach's α ranging between .70 to .90 across the total of five postoperative days.

Concurrent validity

- Spearman rank correlation revealed strong correlations between PPPM-Dv and NRS-11 during five postoperative days. The correlation between the PPPM-Dv and FPS-R revealed moderate to strong correlations (Table III).
- The PPPM-Dv scores also decreased during the five postoperative days (Friedman ANOVA P <.000) and compared to the NRS-11 and the FPS-R scores the same pattern was found (Figure 3).
- Cut-offs on the PPPM-Dv with ROC curve analysis: when NRS-11 scores during the five consecutive postoperative days were analyzed, the assessments with the NRS-11 (cut-off ≥4) revealed on 251 (26%) moments the child was

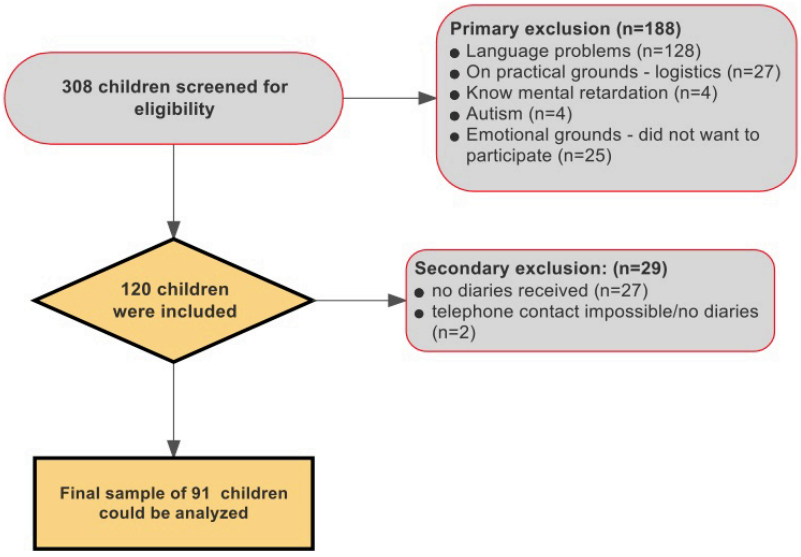


Fig. 2 — Flowchart of inclusion of children and accompanying parents.

Table I. — Characteristics of the children and accompanying parents.

Children		***Accompanying parents***	
N. = 91		*N. = 91*	
Demographic data		**Demographic data**	
sex, male	48 (53.3%)	sex, mother	72 (79.1%)
age, yrs	5.2 ± 2.6	native Belgian	70 (76.9%)
native Belgian	81 (89%)	**SES**	
Age categories		I. education/primary school	18 (19.8)
2 – 5 yrs	55 (60.4%)	II. high school	41 (45.1)
6 – 12 yrs	36 (39.6%)	III. further studies/university	32 (35.2)
Surgical categories		**Religion**	
1. no/mild pain:	40 (43.9%)	none	28 (30.8%)
2. moderate pain:	26 (28.6%)	Christian	22 (24.2%)
3. severe pain:	25 (27.5%)	Islamic	36 (39.6%)
ASA 1	74 (81.3%)	Jewish	5 (5.5%)
ASA 2	17 (18.7%)		

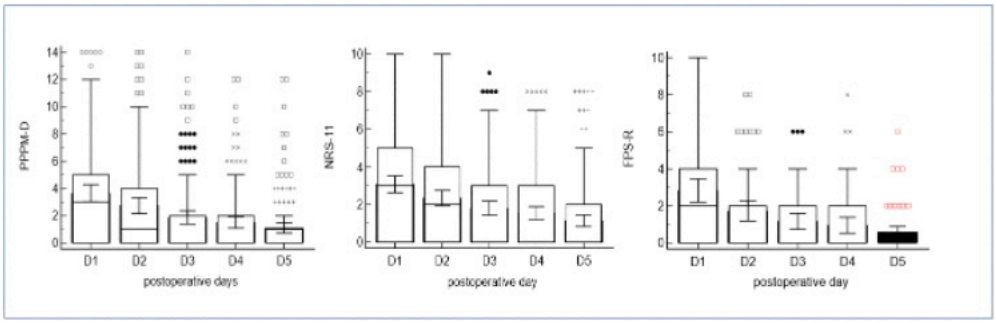
Data are expressed as n (%) or as means with ± standard deviations; SES, socio-economic status based on education level (1. no education/primary school; 2. high school; 3. further studies/university); surgical categories stratified into expected levels of postoperative pain (mild, moderate, severe); ASA, American Society of Anesthesiologists classification.

classified as having moderate to serious pain. Sensitivity and specificity of the PPPM-Dv for predicting moderate to serious pain were assessed using ROC curve analysis with the NRS-11 as reference. This ROC curve analysis of the PPPM-Dv scores revealed an area under the curve (AUC) =.92%; [95% CI: .91-.94] (Figure 4) and identified a score of >2 on the PPPM as the cut-off to distinguish between children with no/mild pain vs moderate to serious pain. With a cut-off on the PPPM >2, the sensitivity (true positive rate) was 89.6% and the specificity (true negative value) was 82% with a positive predictive value 61.6% and a negative predictive value of 96.1%.

Children ≥6 years old using the FPS-R during the five postoperative days were analyzed. The assessment with the FPS-R (cut-off ≥4) revealed that on 69 (19.4%) moments the child was classified as having moderate to serious pain. Sensitivity and specificity of the PPPM-Dv for predicting moderate to serious pain were assessed using ROC curve analysis with the FPS-R as reference. This ROC curve analysis of the PPPM-Dv scores revealed an area under the curve (AUC) =.88%; [95% CI: .88-.91] (Figure 4) and identified a score of PPPM >2 as the cut-off to distinguish between children with no/mild pain vs moderate to serious pain. With a cut-off on the PPPM >2, the sensitivity (true positive rate) was 88.4 % and the specificity (true negative value) was 79.4% with a positive predictive value 50.8% and a negative predictive value of 96.6%.

- Construct validity:

In surgical category 1 the median PPPM-Dv=0



Changes over time of PPPM-Dv, Parents Postoperative Pain Measure Dutch version; NRS-11, Numerical Rating Scale 11; FPS-R, Faces Pain Scale Revised

Fig. 3 — Changes of PPPM-D, NRS-11 and FPS-R during five postoperative days.

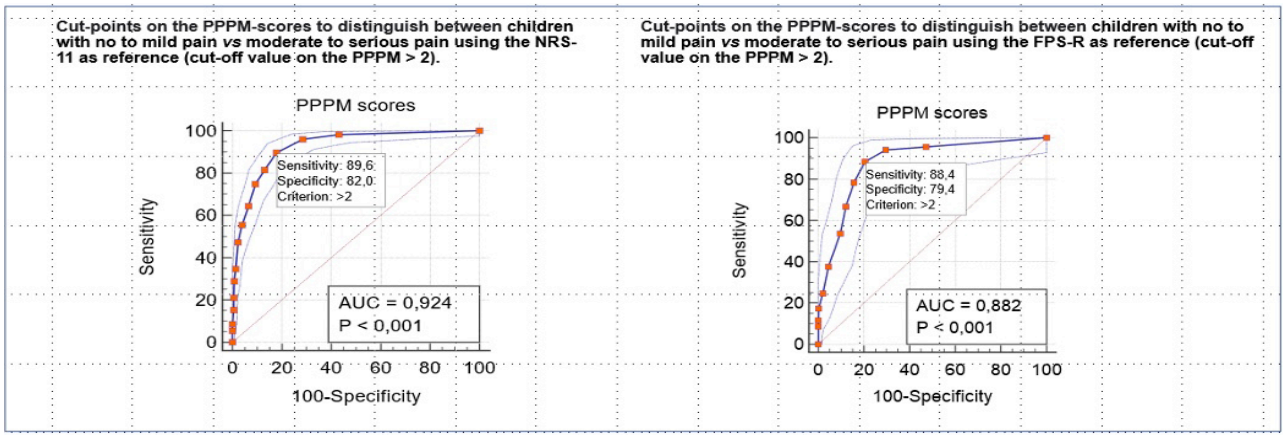


Fig. 4 — Cuts-off on the PPPM-DV.
Cuts-off on the PPPM-DV scores to distinguish between children with no to mild pain vs moderate to serious pain using the FPS-R as reference (cut-off value on the PPPM >2).

Table II. — Reliability - internal consistency of the PPPM-Dv during five postoperative days.

	α	mean	SD
Day 0 before surgery:	0.696	1.76	2.03
Day 0 after surgery at 8 pm:	0.848	5.77	3.94
Day +1 after surgery at 8 am:	0.882	4.14	4.03
Day +1 after surgery at 8 pm:	0.898	3.77	4.21
Day +2 after surgery at 8 am:	0.898	3.40	3.98
Day +2 after surgery at 8 pm:	0.903	3.11	3.93
Day +3 after surgery at 8 am:	0.873	2.14	3.10
Day +3 after surgery at 8 pm:	0.892	2.17	3.28
Day +4 after surgery at 8 am:	0.843	1.57	2.56
Day +4 after surgery at 8 pm:	0.856	1.63	2.66
Day +5 after surgery at 8 am:	0.858	1.25	2.38
Day +5 after surgery at 8 pm:	0.862	1.26	2.39

α, Cronbach's alpha; mean value; SD: standard deviation; PPPM-Dv, Parents' Postoperative Pain Measure – Dutch-version

[95% CI .0 - .0]; in surgical category 2 the median PPPM-Dv=2 [95% CI 1.0 - 2.0]; surgical category 3 the median PPPM-Dv=5 [95% CI 4.0 - 5.0]. The results indicated significantly higher PPPM-Dv scores in category 2 than the PPPM-Dv scores in category 1, z = [-8.68], P<.000; Also, PPPM-Dv scores in category 3 were significantly higher than PPPM-Dv scores in category 2, z = [-6.85], P<.000.

- The GEE revealed no association between PPPM-Dv and SES and religion. However, it did confirm an association between the PPPM-Dv scores and the surgical categories (category 1 = lower scores; category 3 = higher scores) (Table IV).

Discussion

This study aimed to evaluate the reliability and validity of the Dutch version of the PPPM for measuring postoperative pain at home in children aged between 2-12 years. The results provided evidence supporting this reliability and validity of the PPPM-Dv.

Reliability, i.e. the internal consistency of the PPPM-Dv scale was excellent during five postoperative days after a variety of different daycare surgeries (Cronbach's α between .70 to .90). This is in agreement with recent studies[10,14,18].

Validity was established by comparing the PPPM-Dv with global pain scales. The values of rho between the NRS-11 and PPPM-Dv were strong and consistent across the five postoperative days. Also, correlations between the child's FPS-R and the PPPM-Dv proved to be moderate

Table III. — Concurrent validity between children's PPPM-Dv, NRS-11 and FPS-R scores.

	All ages (n= 91)	age 2 – 5 yr. (n=55)	age 6 – 12 yr. (n.=36)
Day 0 (8pm)			
PPPM-Dv/NRS-11	.73* [.62-.82]	.74* [.59-.85]	.67* [.42-.82]
PPPM-Dv/FPS-R	-	-	.43* [.1-.67]
Day 1			
PPPM-Dv/NRS-11	.83* [.77-.87]	.84* [.77-.89]	.79* [.67-.86]
PPPM-Dv/FPS-R			.57* [.39-.71]
Day 2			
PPPM-Dv/NRS-11	.82* [.76-.86]	.83* [.76-.88]	.81* [.71-.88]
PPPM-Dv/FPS-R			.56* [.38-.71]
Day 3			
PPPM-Dv/NRS-11	.75* [.68-.81]	.79* [.70-.85]	.69* [.54-.80]
PPPM-Dv/FPS-R			.49* [.28-.66]
Day 4			
PPPM-Dv/NRS-11	.70* [.61-.77]	.70* [.58-.79]	.66* [.49-.78]
PPPM-Dv/FPS-R			.42* [.18-.61]
Day 5			
PPPM-Dv/NRS-11	.74* [.67-.80]	.79* [.71-.86]	.65* [.48-.77]
PPPM-Dv/FPS-R			.57* [.37-.72]
Day 1 – Day 5			
PPPM-Dv/NRS-11	.81* [.78-.83]	.81*[.78-.84]	.80* [.76-.83]
PPPM-Dv/FPS-R			.61* [.54-.67]

Data are expressed *Spearman Rank correlation (rho) as mean with* 95% confidence intervals of mean in parenthesis, *P<.05. PPPM-Dv, Parents' Postoperative Pain Measure – Dutch version; NRS-11, Numerical Rating Scale; FPS-R, Faces Pain Scale – Revised. Day 1 – Day 5 = all datapoints during five postoperative days

to strong. All these findings are in agreement with published literature[10,12,14,19].

Furthermore, the PPPM-Dv scores decreased during the five postoperative days and these scores followed a similar pattern as the NRS-11 scores and the children's self-reported pain intensity, which is also conform previous findings[13,14].

ROC analysis was conducted to assess sensitivity and specificity of the PPPM-Dv scale for predicting pain, with serving NRS-11 and FPS-R respectively as reference standards respectively. An optimal cut-off point of PPPM-Dv >2 was determined to distinguish between no/mild pain and moderate/severe pain. Although a discrepancy exists between our findings and previous studies where a cut-off point of PPPM ≥6 was found, this is an important finding from a clinical perspective[12]. Further studies will be needed to confirm the accuracy of these cut-offs in a Dutch-speaking population.

Construct validity was considered in relation to different surgical categories. It was already well established that some surgical procedures are more painful than others[16,21]. We hypothesized that the PPPM-Dv scores would follow a same pattern and our findings confirmed that the instrument is indeed sensitive to expected differences.

Furthermore, it is well established that cultural aspects, SES 2 and religion might have an impact on the child's pain management at home[30-32].With a GEE analysis we investigated if PPPM-Dv scores were associated with parental education and parental religion. We did not find such associations. This is indeed important information and might give an indication that the PPPM-Dv can be used in a multicultural environment.

Most research in parental pain assessment has been done by using global assessment tools like a Visual Analogue Scale, a Numerical Rating scale, or a Faces Pain Scale. These instruments have drawbacks because they are subject to a lot of observer bias in absence of specific objective criteria[12,24]. Consequently, in these circumstances it will be difficult for parents to make decisions regarding their child's pain management (f.i. adhere to the prescribed pain medication regime). In contrast, the PPPM-Dv can offer some advantages because it is less prone to observer bias due to the specific objective criteria in contrast to these global pain scales[24].

Table IV. — Generalised Estimating Equation with PPPM-Dv as outcome parameter.

	B	95% Wald CI	P-value
Age child	.367	-.44 – 1.15	.380
Gender child	.045	-.86 – .94	.922
Gender parent	.228	-.802 – 1.26	.664
[a]Surgery cat. 1	-1.78	-2.98 – -.58	.004*
[a]Surgery cat. 3	1.69	.33 – 3.07	.015*
[b]SES 1	-.055	-1.15 – 1.04	.921
[b]SES 3	.204	-.71 – 1.12	.743
[c]Religion 1	.604	-.65 – 1.93	.332
[c]Religion 2	.1.02	-.32 – 2.35	.135
[c]Religion 3	.01	-1.13 – 1.15	.989

GEE models are expressed as regression coefficients; 95% confidence intervals - CI Wald 95%: P-value. Child's age – dichotomy, age 2-5 vs 6-12; SES, socio-economic status based on education level (1. no education/primary school; 2. high school; 3. further studies/university); surgical categories stratified into expected levels of postoperative pain (mild, moderate, severe); religious conviction:

Furthermore, self-report is considered as the gold standard in pain assessment. It is, however, not always possible and suitable for young children who lack the verbal and cognitive skills to provide reliable self-reports[24].

Strengths of this study include the wide age range, a relatively large sample size, the five days follow-up postoperative at home and the wide variety of surgical procedures. Furthermore, this study provides some indication that using the PPPM-Dv is independent of parental SES status and religious conviction. This is clinically very relevant because both SES and religious conviction might have a profound impact on pain management[2,32].

Some limitations of this study need to be addressed. The PPPM-Dv was tested in a single institution on a specific population in which Dutch language fluency is a problem. This might lead to misconceptions about the child's pain management: language problems may have introduced a recruitment bias. There was a relatively large number of dropouts. The analgesic management was not taken into account in our analysis and this could have influenced our results.

From a general point of view this PPPM-Dv has been validated against global assessment tools which only rely on face validity compared to behavior scales[24]. Future studies should confirm the reliability and validity of the PPPM-Dv in larger samples and extended postoperative periods[33]. Also, the short version of the PPPM should be validated in Dutch.

Conclusions

The data of this study provide us with preliminary evidence of the reliability and validity of the PPPM-Dv and offers a promising approach to measure pain at home after a variety of different surgeries in a Dutch speaking population in order to improve global pain management of children at home.

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