ORIGINAL RESEARCH

The postoperative discomfort inventory: A psychometric analysis

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ABSTRACT

Background: Discomfort in the postoperative period is common and may hinder patients' recovery. Factors causing postoperative discomfort have been identified, but a validated tool to assess postoperative discomfort is lacking. We aimed to evaluate the reliability and validity of an instrument designed to assess postoperative discomfort, the Postoperative Discomfort Inventory (PDI).

Methods: We designed a psychometric study that included several longitudinal substudies to establish the preliminary reliability and validity of the PDI. We included all patients in surgical wards on recruiting days who provided written informed consent until the completion of the expected sample size. The study was performed in three samples. The Baseline sample included 125 patients, the Sensitivity sample 51 included patients, and the Recall sample 57 included patients. Discomfort was evaluated using the PDI. Internal-consistency reliability, factor structure, test-retest reliability, and validity were calculated.

Results: Reliability analysis scores reduced the number of items from eleven to nine. Test-retest reliability analysis showed that PDI is sensitive to monitor changes in postoperative discomfort and showed high intraclass correlation in the Recall sample. Validity analysis found that the PDI correlated with the McGill Pain Questionnaire, but correlations were higher with the Global Discomfort Intensity measure.

Conclusions: The PDI is a valid and reliable instrument that can help patients describe postoperative discomfort and thereby improve nursing care.

Key Words: Postoperative discomfort, Assessment, Psychometric analysis, Surgical care

1. INTRODUCTION

Surgery is a recognized cause of stress. Stress is triggered by physiological changes resulting from hormonal and neurophysiological activation. Most of these changes are normal responses to injury aimed at recovering body functions, but they may greatly disturb some patients.[1] The myriad symptoms that patients can experience in the first few days after surgery are known as postoperative discomfort.[2] Some authors consider pain and discomfort synonyms,[3,4] but the concepts differ.[5] Several surveys have established that pain is only one cause of discomfort in postoperative patients.[6–9]

The first reference to postoperative discomfort was Haycock *et al.*'s[10] clinical trial considering the effects of panthenol in reducing postoperative distension, nausea, and vomiting and

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in increasing peristalsis. Importantly, these authors considered not only pain but also other symptoms that might disturb patients after surgery. However, in the years immediately following this trial, this aspect of medical and nursing care was largely ignored.

Postoperative patient discomfort differs with the type of surgery. In oral surgery, discomfort has been extensively taken into account as a component of good outcome, for example, in root canal surgery,[10–17] orthodontic procedures,[18] third molar surgery,[19–22] treatment of caries,[23,24] soft-tissue surgery,[25] and frenectomy.[26] In some surgical procedures, pain is not the main disturbing postoperative symptom. For instance, in eye surgery, after vitrectomy, patients may complain of itching, foreign body sensation, burning, photophobia, and eye dryness more frequently and during more days than pain.[27] After orthognathic surgery for obstructive sleep apnea syndrome, in addition to pain, foreign body sensation and difficulties resuming oral ingestion can accuse discomfort.[28] After thyroid surgery, stretching, choking, or pressing feelings in the neck are highly prevalent.[29] In ear, nose, and throat surgery, nasal obstruction, nasal discharge, foul odor, postnasal drip, and headache are sources of discomfort.[30,31] After urological surgery, discomfort may be associated with specific signs and symptoms.[2] Urinary catheterization may lead to urgency, frequency, and pain; this syndrome is known as catheter-related bladder discomfort.[32–37] In this syndrome, nausea, vomiting, and sedation are not considered part of postoperative discomfort.

In a study with 1,071 patients undergoing outpatient surgery, the main post-discharge symptoms of postoperative discomfort were incision site pain, headache, and somnolence.[38] In another study, Lefevre *et al.*[39] assessed postoperative discomfort after anterior cruciate ligament reconstruction. They found that outpatient patients reported vertigo, nausea and vomiting, malaise, stomachache, pain, and difficulty falling asleep as the most disturbing symptoms in the first days after the surgical procedure. Nausea and vomiting are often considered elements of postoperative discomfort. Karlsson *et al.*[40] used pain, nausea, tiredness, and headache to evaluate the preventive effects of various preoperative approaches before laparoscopic gastric bypass in diabetic women. Postoperative discomfort has also been used to compare the outcomes of two anesthetic induction regimes in short-duration surgical procedures.[41] In this case, the authors evaluated the presence of postoperative upper airway discomfort using the subjective feeling of hoarse or sore throat in the first 24 h after extubation. In the repair of primary inguinal hernia, Fricano *et al.*[3] compared two surgical procedures using a postoperative discomfort evaluation but they only considered pain and patient's return to work. In some studies, discomfort has been limited to a single dimension. For instance, in one study considering the use of drains after mastectomy, Saratzis *et al.*[42] asked patients to rate discomfort associated with sleep interference.

A valid and reliable instrument to assess postoperative discomfort would enable the objective observation of patients' discomfort beyond health professionals' subjective observations. Several questionnaires have been developed to assess some dimensions of postoperative care; these include satisfaction with perioperative care,[43] health outcomes after dental surgery,[44] and patients' postoperative complaints and satisfaction.[45] However, these instruments are unable to assess postoperative discomfort in patients undergoing major surgical procedures.

Physicians and nurses might consider pain the main contributor to discomfort,[8] even when other symptoms are more distressing to patients,[8,9] and this does not help improve patients' well-being in the postoperative period. Zegerman *et al.*[5] found that 22% of patients expressed some discomfort unrelated with pain after general surgery and orthopedic procedures under general anesthesia and recommended inquiring about and trying to alleviate discomfort.

Our group recently identified the main causes of postoperative discomfort as described by patients and healthcare professionals.[8] Based on these findings, we devised an instrument to measure postoperative discomfort: the Postoperative Discomfort Inventory (PDI). Here we aimed to determine the main psychometric properties of the PDI to evaluate its validity and reliability.

2. METHODS

2.1 Participants

Patients were recruited from different surgical wards of a general hospital. All patients who were in the surgical wards on the recruiting days were approached, and those who gave written informed consent were included in the study. To obtain appropriate results with factor analyses, we followed the recommendation of a minimum of five to ten participants per item.[46,47] The initial instrument included 11 items, thus 110 patients were required for the analyses. Based on previous experiences,[8] we assumed that an additional 10% of patients should be added to cover dropouts and losses during the study; thus, we aimed for a sample of 121 patients. Recruitment stopped at the end of the day when the target was reached, so 125 participants were included.

2.2 Study design

The study design considered three samples of patients. The first sample (Baseline sample) included 125 patients who

were interviewed on the second or third day after surgery. The second sample (Sensitivity sample) included 51 patients from the Baseline sample who were questioned on the fourth or fifth day after surgery. The third sample (Recall sample) included 57 patients from the Baseline sample who were interviewed one month after surgery.

Inclusion criteria were elective surgery in the two or three days prior to the first interview, adequate communication abilities, and informed consent. Information on patients' surgical procedures was obtained from clinical histories. Patients were approached by one of the investigators (MC) to test their communication abilities through common questions (patient's name, age, surgery, name of hospital). Patients who were unable to answer the questions and/or were sedated by pain medications were excluded from the study. Patients considered eligible were invited to participate. The rationale for approaching some patients on the second and others on the third day after surgery was for convenience, as the study was done only on weekdays.

2.3 Instruments

The initial version of the PDI included 11 items identified as causing postoperative discomfort in a previous study:[8] pain, nausea, vomiting, insomnia, sleepiness, movement restriction, constipation, flatulence, intravenous drips, dry mouth, and feeling cold. Patients were asked whether each item had contributed to decreasing physical well-being in their postoperative period. If the answer was no, then a score of 0 was assigned; if the answer was yes, patients scored its intensity on a numerical scale from 1 (very mild) to 10 (very severe). Moreover, patients rated the intensity of overall discomfort (Global Discomfort Intensity, GDI) on the same scale.

The McGill Pain Questionnaire-Spanish Version (MPQ-SV)[48] was used to test if PDI scores have a strong correlation with postoperative discomfort. The MPQ-SV is a validated Spanish version of the McGill Pain Questionnaire (MPQ), a well-known instrument to assess both acute and chronic pain.[49] The MPQ-SV consists primarily of three major classes of word descriptors that patients use to describe subjective pain experience: sensory, emotional or affective, and evaluative.

Two studies have analyzed the psychometric properties of MPQ-SV. The first[48] analyzed reliability and validity by means of the procedure described by Vanderiet *et al.*[50] Briefly, the correlations (Spearman's coefficient) were calculated among the items comprising the Pain Rating Index Total (PRI-T), the sum of all scores of all the selected descriptors and its components: the Pain Rating Index Sensory (PRI-S), Affective (PRI-A), and Evaluative (PRI-E). Then, correlations were also calculated with Present Pain Intensity, a verbal rating scale derived from the descriptors of MPQ-SV. The correlations between the values ranged from 0.43 and 0.95, which were similar to those obtained with the original instrument, the MPQ.[49] Next, the MPQ-SV data was administered before and after epidural anesthetic block for labor pain and the difference between scores was calculated. All variables in the MPQ-SV significantly decreased in all cases (at $p < .001$). The second study[51] analyzed the psychometric properties of the MPQ-SV in several Spanish-speaking countries. It showed that the instrument maintained a high internal validity. Correlations between parameters were similar in all countries: ordinal consistency (Pearson's correlation coefficients > 0.90), intercategory consistency (Pearson's correlation coefficients between PRI scores were 0.89-0.99), interparameter consistency (Pearson's correlation between PRI-T scores and Number of Word Chosen, 0.75-0.95), and quantitative-to-quantitative consistency (Pearson's correlation coefficient between VAS scores and PRIT-T, 0.35-0.64).

2.4 Procedure and data collection

Three interviews were conducted. The first interview, done in the Baseline sample, collected information on demographic characteristics, surgical procedure, discomfort (measured by the PDI), and pain characteristics (measured by the MPQ-SV). In the subsequent interviews, only the questions in the PDI were asked. Another interview, done in the Sensitivity sample two days after the first interview, enabled researchers to determine test-retest reliability for the PDI. The third interview, done in the Recall sample one month after the first interview, aimed to determine patients' memory of discomfort experience and the importance of PDI items after discharge. In all interviews patients were assisted in filling out the answers to the questions. Patients in the Baseline and Sensitivity samples were interviewed in the hospital; patients in the Recall sample were interviewed by phone in their homes. The Baseline interview took approximately 30 min; the Sensitivity and Recall interviews took 20 min or less.

2.5 Statistical analysis

Differences among demographic data in the initial sample were analyzed using ANOVA, Student's t test, and χ^2 tests. Parametric tests were performed when group sizes were small or normal distribution was not guaranteed.

To establish the psychometric properties of the PDI, we considered the following:

- Initial selection of items: Scores of each PDI item in the Baseline sample were analyzed by means of inter-items Pearson's correlation and Cronbach's α.

Cronbach's α was calculated repeatedly to observe how the exclusion of each item affected the PDI's internal-consistency reliability. These analyses made it possible to determine which of items agreed with a common construct and could be used in the next analysis.

- Factor structure analysis: Once the items were selected, the new PDI was analyzed to determine how items were grouped in the corresponding domains. To this end, an exploratory factor analysis using the principal component method and Oblimin rotation with the Kaiser criterion was used.
- Reliability studies: Internal-consistency reliability was calculated by Cronbach's α. Test-retest reliability was calculated by intra-class correlation including the three measurements of PDI recorded during the study.
- Ability to monitor changes in postoperative discomfort: We compared PDI scores from the initial and subsequent interviews in the Sensitivity sample, and from the initial and subsequent interviews in the Recall sample. Differences within groups were tested by repeated Student's *t*-tests. Cohen's d was calculated to determine the size of the effect. We expected a significant decrease in PDI scores between the initial and subsequent interviews in the Sensitivity sample, as a result of patients' recovery. However, we expected no differences in PDI scores between the two interviews done in the Recall group.
- Validity studies: Since the construct of postoperative discomfort was not previously defined, the validity of PDI constructs was tested by hypothesis testing or by examining their relationships with close construct measures in the Baseline sample. In previous studies, women scored some components of postoperative discomfort higher than men,[9] and scoring also varied among surgical departments.[8] Therefore, we hypothesized that these differences would also be evident in PDI scores. To test these hypotheses, we used Student's *t*-test or ANOVA when the sample size and the distribution of the variable allowed a parametric test, and the Mann-Whitney U when a nonparametric test was necessary. Moreover, to test whether PDI scores were closely related with postoperative discomfort or with pain, we used Pearson's correlation coefficients to assess the association of the PDI with a Global Discomfort Intensity (GDI) score, and MPQ-SV scores.

2.6 Ethical considerations

Our center's Ethical and Clinical Research Committee approved the study protocol. Patients were approached on the second or third day after surgery. The investigator (MC) informed eligible patients whose communication abilities were considered adequate about the aims and procedures of the study, as well as the possibilities of being interviewed two or three times. If they agreed to participate, the investigator asked them to sign the consent form.

3. RESULTS

3.1 Patients

Table 1 shows the demographic data of the samples. Women were older than men in the Baseline (55.7 $\pm$ 13.6 *vs.* 47.8 $\pm$ 14; t = 3.13; d.f. = 123; $p < .01$), Sensitivity (56.3 $\pm$ 14.1 *vs.* 47.2 $\pm$ 16; t = 2.12; d.f. = 49; $p < .05$), and Recall samples (56.7 $\pm$ 9.8 *vs.* 49.5 $\pm$ 13.1; t = 2.38; d.f. = 55; $p < .05$). More patients were from the Orthopedic Surgery department than from the General Surgery or the Obstetrics and Gynecology department.

Table 1. Demographic characteristics of the three samples of patients

	Baseline sample (n = 125)	Sensitivity sample (n = 51)	Recall sample (n = 57)
Age (years)*	52.8 (14.2)	52.7 (15.4)	53.6 (11.8)
Gender (women)**	63.2 (79)	60.8 (31)	56.1 (32)
Department**			
General surgery	33.6 (42)	33.3 (17)	29.8 (17)
Obstetrics & Gynecology	20 (25)	23.5 (12)	15.8 (9)
Orthopedic surgery	46.4 (58)	43.1 (22)	54.4 (31)

*Values are expressed as mean (SD); ** Values are expressed as percentage (n).

3.2 Initial selection of items

Inter-items correlations and Cronbach's α values showed that two items included in the initial PDI had a low correlation with most of the other items (see Table 2): Intravenous drips (correlation coefficient range: 0.09-0.18) and Feeling cold (correlation coefficient range: 0.06-0.19). When these two items were excluded, Cronbach's α increased to values higher than 0.70, so we excluded them from subsequent analyses.

Table 2. Cronbach's α coefficient values when the item is deleted and inter-items Pearson correlations

Items	Cronbach's α	Nausea	Vomiting	Insomnia	Sleepiness	Movement restriction	Constipation	Flatulence	Intravenous drips	Dry mouth	Feeling cold
Pain	0.68	0.22*	0.10	0.27**	0.34**	0.35**	0.01	0.23**	-0.09	0.27**	0.02
Nausea	0.66	1	0.73**	0.13	0.29**	0.17	0.30**	0.07	0.06	0.37**	0.05
Vomiting	0.67		1	0.10	0.24**	0.11	0.30**	0.13	0.09	0.28**	0.19*
Insomnia	0.67			1	0.30**	0.21*	0.08	0.05	0.18*	0.3**	0.07
Sleepiness	0.64				1	0.33**	0.33**	0.28**	0.003	0.36**	0.10
Movement restriction	0.68					1	0.10	0.16	-0.04	0.25**	0.01
Constipation	0.69						1	0.32**	0.14	0.09	-0.06
Flatulence	0.68							1	0.06	0.19*	-0.02
Intravenous drips	0.72								1	-0.05	0.01
Dry mouth	0.65									1	0.13
Feeling cold	0.71										1

* $p < .05$; ** $p < .01$.

3.3 Factor structure analyses

An initial, exploratory factor analysis showed a three-factor solution. The first factor (eigenvalue = 2.93) explained 32.59% of the total variance, while the other two factors (eigenvalue = 1.42 and 1.13) explained 15.76% and 12.56%, respectively. As the scree plot indicated two factors should be retained and rotated, and only two items should be loaded in the second (Vomiting and Nausea) and third factors (Flatulence and Constipation), the factor analysis was repeated by straining a two-factor solution. The matrix structure showed that six items (pain, sleepiness, movement restriction, dry mouth, insomnia, and flatulence) loaded in the first factor and the other three (vomiting, nausea, and constipation) in the second explained 32.59% and 15.76% of the total variance, respectively (see Table 3). That the percentage of the variance explained by the first two factors was identical in the three factor and two factors models was a coincidence. Correlation values between factors were 0.35 ($p < .001$) and between total-factors scores were 0.91 ($p < .001$) and 0.71 ($p < .001$) for Factors 1 and 2, respectively (see Table 3).

Table 3. Structured matrix of the nine-item version of the PDI

Items	Factor 1	Factor 2
Pain	0.71	
Sleepiness	0.70	- 0.40
Movement restriction	0.65	
Dry mouth	0.61	- 0.40
Insomnia	0.59	
Flatulence	0.43	- 0.26
Vomiting	0.20	- 0.88
Nausea	0.30	- 0.87
Constipation	0.21	- 0.59

Note. Items with factors load lower than 0.10 are not included in the table.

3.4 Reliability studies

Once the initial PDI was shortened to nine items (See Initial Selection of Items subsection), internal-consistency reliability was again calculated. Cronbach's α for the total PDI was then 0.73, and the mean interclass correlation was 0.23 ($p < .001$). Cronbach's α for Factor 1 and Factor 2 was slightly lower than the value for total PDI (0.68 and 0.66, respectively).

Test-retest reliability was low between the PDI scores from the Baseline and Sensitivity interviews, but high between the Baseline and Recall interviews. In this sense, while the intra-class correlation between PDI scores in the Baseline and Sensitivity interviews were 0.20 for the total PDI score (0.17 for Factor 1 and 0.49 for Factor 2), the intra-class correlations for the Baseline and the Recall interviews were 0.68 for the total PDI score (0.71 for Factor 1 and 0.71 for Factor 2).

3.5 Monitoring changes in postoperative discomfort

Table 4 reports the total PDI and PDI Factor 1 and PDI Factor 2 scores in the three samples of patients. Test-retest analyses showed a significant reduction in total PDI scores between the first and second interview in the Sensitivity sample (Cohen's d = 1.10). When the analyses were carried out by factors, the results were similar (Cohen's d = 1.07 for Factor 1 and 0.62 for Factor 2). In the Recall sample, there were no significant differences between the PDI scores for the first interview and the interview conducted one month later (Cohen's d = 0.07 for Total PDI, 0.04 for PDI Factor 1, and 0.08 for PDI Factor 2) (see Tables 4 and 5).

3.6 Validity studies

Table 4 reports the PDI scores for each sample by gender. Differences between gender were observed in all PDI scores

(Total score: $t_{(118.80)} = 4.57$, Cohen's d = 0.84; Factor 1: $t_{(116.82)} = 3.16$, $p < .01$, Cohen's d = 0.58; Factor 2: $t_{(121.17)} = 5.00$, $p < .001$, Cohen's d = 0.91). Moreover, women also had higher Factor 2 and total PDI scores than men in the subgroup who underwent general surgery (Total score: Mann Whitney U test = 135.00, $p < .05$, Cohen's d = 0.80; Factor 2 score: Mann-Whitney U test = 109.00, $p < .05$, Cohen's d = 1.00) and in all the PDI scores in the subgroup who underwent orthopedic surgery (Total score: Mann-Whitney U test = 174.00, $p < .001$, Cohen's d = 1.08; Factor 1 score: Mann-Whitney U test = 180.50, $p < .001$, Cohen's d = 1.05, and Factor 2 score: Mann-Whitney U test = 237.50; $p < .01$, Cohen's d = 0.67).

Table 4. Total PDI, Factor 1, and Factor 2 scores in the three samples of patients by gender. Values are expressed as mean (SD)

	Total		Women		Men	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Baseline sample						
Factor 1	19.34	12.94	21.83	13.81	15.04	10.06
Factor 2	5.92	7.71	8.02	8.46	2.30	4.29
Total	25.26	17.22	29.86	17.54	17.35	12.55
N	125			79		46
Sensitivity sample						
Factor 1	8.51*	9.43	9.71	10.52	6.65	7.31
Factor 2	1.92*	5.08	3.03	6.27	0.20	0.89
Total	10.43*	11.94	12.74	13.80	6.85	7.26
N	51		31		20	
Recall sample						
Factor 1	18.21†	14.35	20.75	15.50	14.96	12.29
Factor 2	5.17†	7.78	7.31	8.73	2.44	5.39
Total	23.39†	18.72	28.06	19.43	17.40	16.23
N	57		32		25	

* Differences with the Baseline sample scores are statistically significant ($p < .001$). Comparisons were carried out by means of repeated Student's *t*-test.
† Differences with the Baseline sample scores are not statistically significant. Comparisons were carried out by means of a repeated Student's *t*-test.

Table 5. Total PDI, Factor 1, and Factor 2 scores in the three samples of patients by surgical department. Values are expressed as mean (SD)

	General surgery	**Obstetrics & Gynecology**	**Orthopedic Surgery**
Baseline sample			
Factor 1	12.21 (12.88)	14.32 (9.05)	21.59 (13.94)
Factor 2	5.90 (13.94)	9.28 (8.74)	4.48 (.88)
Total	25.12 (17.91)	23.60 (14.52)	26.07 (2.36)
N	42	25	58
Sensitivity sample			
Factor 1	9.24 (9.19)	5.33 (5.73)	9.64 (11.07)
Factor 2	1.06 (2.54)	2.25 (4.27)	2.41 (6.79)
Total	10.35 (9.96)	7.58 (6.20)	12.04 (15.38)
N	17	12	22
Recall sample			
Factor 1	13.65 (11.05)	10.67 (10.61)	22.90 (15.43)
Factor 2	4.41 (6.74)	9.00 (10.06)	4.48 (7.53)
Total	18.06 (13.80)	19.67 (17.96)	27.39 (20.39)
N	17	9	31

The PDI scores were also compared among surgical departments (see Table 5). The ANOVA of PDI scores found no significant differences in total PDI score ($F_{(122,2)} = 0.18$, $p = .84$), but did find a significant difference in Factor 2 scores ($F_{(122,2)} = 3.52$, $p = .03$) and a nearly significant trend in Factor 1 scores ($F_{(122,2)} = 2.84$; $p = .06$). The significant difference in Factor 2 indicated lower scores in orthopedic surgery than in obstetrics and gynecology ($t_{(81)} = 2.72$; $p = .008$, Cohen's d = 0.60). Moreover, despite the trend observed in Factor 1, the post hoc analysis showed that, contrary to the results observed in Factor 2, orthopedic surgery scored higher than obstetrics and gynecology in Factor 1 ($t_{(81)} = 2.39$; $p = .02$, Cohen's d = 0.53).

We also analyzed the PDI construct of postoperative discomfort by comparing it with the GDI score to see if it was strongly related with this other construct of postoperative discomfort, with the MPQ-SV score to see if it was strongly related with pain. Total PDI scores correlated significantly with the GDI and all MPQ-SV categories; total PDI score correlated more strongly with GDI than with all MPQ-SV categories (see Table 6). Separating total PDI into Factor 1 and Factor 2 revealed some differences. Factor 1 scores significantly correlated with all MPQ-SV scores and GDI. However, Factor 2 scores correlated significantly only with the affective category of the MPQ-SV category ($r = 0.19$, $p < .05$). As was observed with total PDI scores, correlations between PDI factors and GDI were always higher than correlations between PDI factors and all MPQ-SV categories.

Table 6. Pearson correlations of PDI scores with Global Discomfort Intensity (GDI) and MPQ-SV

	GDI	Sensory category	Affective category	Evaluative category	Total MPQ-SV
Factor 1	0.65**	0.51**	0.56**	0.57**	0.58**
Factor 2	0.28**	0.11	0.19*	0.13	0.14
Total	0.62**	0.43**	0.51**	0.49**	0.50**

* $p < .05$; ** $p < .01$.

4. DISCUSSION

The present study aimed to evaluate the psychometric properties of the PDI as a measure of postoperative discomfort. The preliminary results presented here indicate that the PDI construct of postoperative discomfort is better described by two factors. The first factor could be defined as general discomfort, and the second factor could be defined as digestive difficulties.

In the process of validating the PDI, the number of items in the initial instrument was decreased from 11 to 9 because the items "feeling cold" and "intravenous drips" did not correlate with the remaining items. These results suggest that, even though feeling cold or having intravenous drips may disturb some patients, these items do not fit in the construct of postoperative discomfort defined by the other nine items. In a study on patients' satisfaction with perioperative care,[43] pain ranked as the most prevalent discomfort-causing factor in the two days after surgery, followed by thirst and feeling cold. However, only pain and thirst were significantly severe; feeling cold was not scored as undesirable. Our study corroborates that feeling cold is not especially important to patients. Hüppe *et al.*[45] also found that almost 40% of patients reported feeling cold; this was the fourth most prevalent type of discomfort, after dry mouth/thirst (87%), pain at surgery site (80%), and croakiness (61%). However, these patients were interviewed just after anesthetic effects disappeared and the intensity for feeling cold was lower than for most other items.

The factorial analysis fitted a model with two factors. The second factor included most digestive symptoms, such as vomiting, nausea, and constipation. Digestive symptoms may be offside effects of opioid drugs, which would also help explain the high value of sleepiness and dry mouth in the Factor 2, even though these two items scored the highest in Factor 1. However, these items are unspecific and may be a consequence of different situations besides opioid administration.

When gender groups were compared, women scored higher than men on all the PDI scores; this finding is consistent with those reported by other authors.[45,52] This finding is difficult to explain. In our study, women who underwent obstetrics and gynecology surgery had similar PDI scores to women and men undergoing general surgery or orthopedic surgery, with lower scores in Factor 2 items than the other groups. Hüppe *et al.*[52] recently showed that the expectation of postoperative complaints is important in predicting the prevalence of symptoms after surgery. In their study, women scored higher than men in their expectation of complaints in the postoperative period. Their logistic regression analysis revealed that expectation was an independent predictor of nausea and pain. Therefore, women's expectations about postoperative distress, based on previous experiences or be-

liefs, may partially explain the gender differences.

Our data comparing the PDI with the MPQ-SV and GDI are important to understand how pain and discomfort may be related. Correlations of MPQ-SV with Factor 1 items are clearly higher than correlations with Factor 2 or the total PDI. This is probably due to the inclusion of pain in Factor 1, but correlations with the total PDI are still significant and are always around 0.5. When we analyzed the relationship between the PDI and GDI, we also found significant correlations with both PDI factors and with total PDI, but the correlation with Factor 2 was weaker. Importantly, correlations were higher between PDI and GDI than between PDI and MPQ-SV, indicating that PDI is more related with overall postoperative discomfort than with pain perception. Nevertheless, in comparison to Factor 2, Factor 1 correlated more strongly with GDI and all the MPQ-SV scale, suggesting that while postoperative discomfort is not only pain, pain plays a significant role in patients' perception of discomfort. This is an important point, as it reinforces the idea that pain and discomfort are distinct constructs.

This study has several limitations. Our sample selection, the timing of data collection, and the single-center approach may preclude the generalization of findings to other surgical settings and postoperative days. However, we conducted three interviews that allowed us to obtain information in three periods, we included patients from different surgical departments, and we checked the differential importance of the items. We did not study patients very early in the postoperative period (*i.e.*, within the first postoperative day) because of the difficulties in ensuring adequate interviews; findings in this period would probably differ. Likewise, we did not take into account differences that might derive from specific surgical procedures. Notwithstanding, we consider that the PDI's psychometric properties make it suitable to explore any issue related to postoperative discomfort.

A critical question is how this instrument could improve the assessment of discomfort in postoperative patients. The results reported here give only the initial data on the psychometric properties of a new instrument. Until now, discomfort has been evaluated by asking patients about the presence and intensity of many nuisances as, for instance, nausea, vomiting, pain, or the presence of medical devices. The PDI makes it possible to systematically assess patients' wellbeing, as health professionals do no need to suspect that a patient has a specific symptom to ask about it. The PDI may help detect causes of discomfort that might go unnoticed because they are not routinely included in inquiries.[5] Further studies might confirm this initial speculation.

Impact in nursing

This study provides a validated and reliable tool that can be used to evaluate postoperative discomfort. This instrument can help in screening for the causes of discomfort after surgery and potentially improve nursing care and patients' well-being.

5. Conclusion

The psychometric properties of the PDI, an instrument devised to assess postoperative discomfort, show that this instrument has adequate reliability and validity to be used in clinical settings. The PDI is a tool that can be used in most patients in the postoperative period. It is a reliable instrument, and it is sensitive to changes in postoperative discomfort over time. Although validity of the construct is difficult to establish, PDI discomfort seems to be related more closely to general measures of discomfort than to pain.

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Conflicts of Interest Disclosure

The authors declare that they have no competing interests.

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