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Citation for the original published paper (version of record):

Wikström, L., Eriksson, K., Fridlund, B., Nilsson, M., Årestedt, K. et al. (2017)
The clinical applicability of a daily summary of patients' self-reported postoperative pain - a repeated measure analysis.
Journal of Clinical Nursing, 26(23-24): 4675-4684
<https://doi.org/10.1111/jocn.13818>

Access to the published version may require subscription.

N.B. When citing this work, cite the original published paper.

Permanent link to this version:

<http://urn.kb.se/resolve?urn=urn:nbn:se:hj:diva-35350>

MRS. LOTTA WIKSTRÖM (Orcid ID : 0000-0002-1423-7506)

Received Date : 25-Oct-2016

Revised Date : 07-Mar-2017

Accepted Date : 12-Mar-2017

Article type : Original Article

The clinical applicability of a daily summary of patients' self-reported postoperative pain - a repeated measure analysis

Lotta WIKSTRÖM ^{a, b} RN, PhD student

Kerstin ERIKSSON ^{a, b} RN, PhD student

Bengt FRIDLUND ^a RN, RNT, PhD, Professor

Mats NILSSON ^c PhD, Statistician

Kristofer ÅRESTEDT ^{d, e} RN, PhD, Professor

Anders BROSTRÖM ^{a, f} RN, PhD, Professor

^a School of Health and Welfare, Jönköping University, Jönköping,

^b Department of Anaesthesia and Intensive Care, Ryhov County Hospital, Jönköping,
Sweden

^c Futurum, - Academy for Health and Care, Region Jönköping County, Sweden

^d Faculty of Health and Life Sciences, Linnaeus University, Kalmar

^e Department of Medical and Health Sciences, Division of Nursing Science, Linköping
University, Linköping, Sweden

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi:
10.1111/jocn.13818

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^fSweden Department of Clinical Neurophysiology, University Hospital, Linköping, Sweden

Address for correspondence, reprint requests and proofs: Lotta Wikström RN, PhD student, Department of Anaesthesia and Intensive Care, Ryhov County Hospital, SE-551 85 Jönköping, Sweden. Telephone number: +4636321000, fax number: +4636325055, e-mail: charlotta.vikstrom@rjl.se

Abstract

Aim and objectives

(I) to determine if a central tendency, median, based on patients' self-rated pain is a clinically applicable daily measure to show patients' postoperative pain on the first day after major surgery (II) and to determine the number of self-ratings required for the calculation of this measure.

Background

Perioperative pain traits in medical records are difficult to overview. The clinical applicability of a daily documented summarising measure of patients' self-rated pain scores is little explored.

Design: A repeated measure design was carried out at three Swedish country hospitals.

Methods

Associations between the measures were analysed with non-parametric statistical methods; systematic and individual group changes were analysed separately. Measure I: pain scores at rest and activity postoperative day 1; measure II: retrospective average pain from postoperative day 1.

Results

The sample, 190 general- and 289 orthopaedic surgery patients with a mean age of 65; 56% were men. 44% had a pre-operative daily intake of analgesia, and 77% used postoperative opioids. A range of 4–9 pain scores seem to be eligible for the calculation of the daily measures of pain. Rank correlations for individual median scores, based on four ratings, versus retrospective self-rated average pain, were moderate and strengthened with increased numbers of ratings. A systematic group change towards a higher level of reported retrospective pain was significant.

Conclusions

The median values were clinically applicable daily measures. The risk of obtaining a higher value than was recalled by patients seemed to be low. Applicability increased with increased frequency of self-rated pain scores and with high-quality pain assessments.

Relevance to clinical practice

The documenting of daily median pain scores at rest and during activity could constitute the basis for obtaining patients' experiences by showing their pain severity trajectories. The measures could also be an important key to predicting postoperative health-related consequences.

What does this paper contribute to the wider global clinical community?

- Daily median scores, summarised from patients' self-rated pain scores with the NRS, are applicable clinical measures in the documentation of adults postoperative pain at rest and on activity.
- There is postoperatively a low risk of obtaining median pain scores that represent more pain than was recalled by patients.

- Applicability of postoperative median pain scores from patients' self-rated pain scores with the NRS, increases with the number of collected ratings and the quality of pain assessments.

Keywords: documentation, numerical rating scale, pain, self-rated, pain, repeated measures

Introduction and background

Postoperative pain is an unpleasant experience that despite the use of multimodal pain management approaches is experienced by many patients after surgery (Carr *et al.* 2014, Fletcher *et al.* 2008). Persistent postoperative pain affects patients' perceptions of care negatively (Schwenkglenks *et al.* 2014) and may lead to health-related and psychosocial consequences (Liu & Wu 2007). It is therefore important to monitor pain in postoperative care (Breivik *et al.* 2008, Gordon *et al.* 2010, Meissner *et al.* 2015).

Recommendations for frequent screening and reassessments of patients' pain after surgery are based on the fact that it is possible to prevent severe postoperative pain (Breivik *et al.* 2008, Gordon *et al.* 2010, Meissner *et al.* 2015). However, the communication of pain is associated with several barriers (Jacobsen *et al.* 2009, Wikström *et al.* 2014). Therefore, the provision of a tool to facilitate communication of pain intensity has for many years been recommended (Mc Caffery & Pasero 1997). Several one-dimensional scales, such as the Numeric Rating Scale (NRS), the Visual Analogue Scale (VAS), Verbal scales and Facial Scales, are validated and considered reliable in clinical use (Hjermstad *et al.* 2011, Williamson & Hoggart 2005). Although the VAS is the most frequently-used scale in research, the NRS is according to a recent review by Hjermstad *et al.* (2011) preferred by patients and is the most commonly-used scale in the clinical context because of its ease of use in different settings.

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In the clinical context, the NRS provides healthcare professionals with a uniform language which has been shown to limit the risk of misunderstandings (Wikström *et al.* 2014). However, misunderstandings are a possibility when healthcare professionals base their interventions on their own interpretations, rather than exploring patients' perception of pain with the NRS (Wikström *et al.* 2016). It is also apparent that the distance between scores varies between individuals (Farrar *et al.* 2010, Wolrich *et al.* 2014). This is explained by the design of the NRS, where each patient assigns their own interpretation to each number, based on their life experience and interpretation of the end-point description (Farrar *et al.* 2010). Despite these confounding factors, healthcare professionals have stated that patients' self-rated pain scores benefit the communication of pain (Wikström *et al.* 2014).

The assessment of pain both at rest and on activity is highlighted in guidelines (Brantberg & Allvin 2017, Gordon *et al.* 2010). Nevertheless, in a clinical context, pain scales are not found to be used with regular repetition at rest and on activity (Carr *et al.* 2014, Fletcher *et al.* 2008, Samuels & Eckardt 2014), with the result that patients' self-reported pain in medical records is difficult to overview (Fletcher *et al.* 2008, Samuels 2012). This may increase the risk of excluding the patient's "voice" in decisions regarding pain management strategies, with a potential risk for the under- or over-treatment of pain. Furthermore, the first postoperative days are important when predicting the risk of developing health-related consequences such as chronic pain (Stubhaug & Breivik 2007). The daily documentation of a central tendency from patients' self-rated pain intensity scores would in a simple way show up patients with persistent severe postoperative pain after major surgery. To achieve measures that correspond to the intensity of pain experienced by patients, it is necessary to determine how many pain ratings are required for a reliable central tendency. Retrospective average pain has been shown to be associated with self-reported pain scores when dividing the NRS into two groups:

0–3 for mild pain and 4–10 for moderate to severe pain (Eriksson *et al.* 2013). However, there is no evidence of agreement on the full range of NRS, nor of the frequency of pain ratings required when patients' pain is described with a daily measure. The aim was therefore:

(I) to determine if a central tendency, median, based on patients' self-rated pain scores, is a clinically applicable daily measure to describe patients' postoperative pain on the first day after major surgery, and;

(II) to determine the number of self-ratings needed for the calculation of this measure.

Methods

Design and setting

This study had a repeated measure design, including two sets of measures of postoperative pain on postoperative days 1 and 2. The study was conducted at six care units at three different county hospitals in Sweden. The number of beds in the three hospitals was between 300 and 400. The catchment areas were both rural and urban, with 414,000 inhabitants in total. Assessment of postoperative pain with the NRS had been used in past years at the care units that were included in the study.

Sample

A convenience sample of 582 patients undergoing scheduled major general or orthopaedic surgery were asked to participate one to two weeks before surgery. Designated research nurses at three general surgery and three orthopaedic pre-operative receptions identified and included patients eligible for the study, which took place between October 2012 and January 2015. Inclusion criteria were: patients of 18 years or older, undergoing scheduled major general or orthopaedic surgery, expected to have a length of stay ≥ 2 days, orientated to time

and environment, and able to understand both spoken and written Swedish language. Exclusion criterion was: postoperative intensive care. Patients asked to participate were n=582, of whom n=41 declined to do so. Figure 1 describes the number of patients completing the study, the procedure of data collection and the reasons for dropout.

Insert figure 1

Data collection

The research nurses collected socio-demographic data; age, gender, country of birth, pre-hospital average pain (NRS) at rest and on activity, as well as daily intake of analgesia before inclusion. Clinical information about surgery, physical status classification (ASA 2016), anaesthetics and postoperative pain management were obtained from the computerised medical journals.

Measure I: On postoperative day 1, self-rated pain scores “right now” were collected by the nurses in charge. A pain protocol designed for the study was used, with enclosed instructions to assess and register patients’ self-rated postoperative pain at rest and on activity with the verbally communicated NRS every fourth hour, at breakthrough pain, and at reassessments after receiving analgesia. If the patients were asleep, no assessment of pain was made. The instructions were based on international and national guidelines (Brantberg & Allvin 2017, Gordon *et al.* 2010).

Measure II: In the morning of postoperative day 2, the patients were asked to retrospectively summarise their postoperative pain from postoperative day 1. The nurse in charge delivered a protocol where the patients registered their average pain experienced at rest and on activity separately with NRS scores on a horizontal scale.

Ethical Considerations

Ethics for inclusion and performance of the study followed the intentions of the Helsinki Declaration WMA (2013). Patients eligible for the study were asked about participation regardless of ethnicity, sex or socio-economic status. All patients fulfilling inclusion criteria received written and oral information and gave verbal consent, and collected data was kept confidential. Approval was obtained from the Ethical Review Board in Linköping, Sweden (M249-08).

Data analyses

Descriptive statistics (frequency, percentage, mean, range) and non-parametric tests (Mann-Whitney U, Pearson Chi-square and Wilcoxon Signed Rank test) were used to analyse socio-demographic and clinical data. Prevalence of pre- and postoperative pain was reported as median and quartiles.

When determining prevalence of pain and summarising pain into individual median NRS scores, it was deemed clinically appropriate to exclude patients who at measure I had less than four recorded pain scores. This decision was based on the recommendation that patients with ongoing acute pain should be assessed frequently (Gordon *et al.* 2005). To determine the associations between the individual calculated median scores from measure I and retrospective self-rated average pain scores from measure II, Multiple Spearman rank correlations were performed. Groups of patients were created who had exact 4, 4–9, 5–9 or 6–9 recorded ratings, and these were analysed separately. When patients had indicated two scores at one rating, for example 3–4, the highest was used. The median was rounded upwards when necessary to the nearest integer number. IBM SPSS Statistics (IBM Corp, Armonk, NY) were used for the analysis of the data.

To determine patterns of change between the measures, medians from self-rated pain scores “right now” on postoperative day 1 and retrospective self-rated average pain on postoperative day 2, pair-wise agreements (Percentage Agreements), systematic disagreements (Relative Position, Relative Concentration) and individual variability (Relative Rank Variance) were analysed separately using Svensson’s method in a free software program (Avdic & Svensson 2010). This method is suitable for paired-ordered categorical data that inherit a ranking without information regarding the size between points.

In the Svensson method, pair-wise identical answers are reported in *Percentage Agreement*. Systematic disagreement refers to the group level. The *Relative Position* estimates the systematic change in probability (%) between days one and two: the probability of reporting less pain at day two than at day one, minus the probability of reporting more pain at day one than day two (or vice versa). The measure of *Relative Position* is based on the cumulative frequency of variable values, ranging from -1 to +1, of having a lower or higher value at the second measure. The *Relative Concentration*, ranging from -1 to +1, represents the calculation of the concentration of the systematic change. A value close to +1 indicates answers concentrated to a certain score on the NRS at the first measure and vice versa for a negative value. Individual variations unexplained by the systematic change were calculated with the *Relative Rank Variance*, ranging from 0 to 1. A certain individual variation is expected but a Relative Rank Variance >0.20 indicates a non-negligible heterogeneity. The analyses of Relative Position and Relative Rank Variance were described with confidence intervals of 95%. A Relative Position close to 0 (additionally a confidence interval that covers 0) and a Percentage Agreement close to 100% indicated no significant change between the two sets of measures (Avdic & Svensson, 2010).

Results

Demographic and clinical data

In total, 479 patients scheduled for major general- or orthopaedic surgery completed the study. There were no differences between the general surgical (n=190) and orthopaedic (n=289) group regarding age, country of birth or ASA classification. Differences were found for sex, pre-hospital levels of pain (NRS) and analgesia, peri-operative anaesthesia, and postoperative pain management (Table 1). In the orthopaedic group, there were larger proportions of men, patients with pre-operative pain, intake of analgesia, and postoperative intake of opioids.

Insert table 1

Self-rated pain from measure I and II

The proportion of patients who had their pain registered ≥ 4 times in *measure I* was 81.6% at rest and 75.2 % at activity; the proportion of patients with registered pain ≥ 6 times was 29.0% at rest and 22.7% on activity (Table 2). Retrospective average pain in *measure II* at rest and on activity was reported by 97.9% and 97.3% patients respectively.

Insert table 2

Self-rated pain in *measure I* (median at rest: 2, q1-q3= 0-4 and median on activity: 4, q1-q3=2-6) were significantly lower (rest: Wilcoxon Rank Test $p<.001$, activity: Wilcoxon Rank Test $p<.001$) than self-rated retrospective pain in *measure II* (median at rest: 3, q1-q3= 2-5 and median on activity: 5, q1-q3=3-7). Pain at rest was significantly lower in comparison with activity in *measure I* (Wilcoxon Rank Test $p<.001$) and *measure II* (Wilcoxon Rank Test $p<.001$).

Associations of average pain scores between measure I and II

Rank correlations for calculated individual median scores from *measure I*, based on four ratings, versus retrospective average pain from *measure II*, were moderate, $r_{\text{Spearman}} = .61$ ($p < .001$) at rest and $r_{\text{Spearman}} = .57$ ($p < .001$) during activity. Pain showed a pattern of increased correlational strength up to $r_{\text{Spearman}} = .68$ ($p < .001$) at rest and $r_{\text{Spearman}} = .66$ ($p < .001$) on activity with an increased number of pain ratings. The pattern at rest was more evident than that on activity (Table 3).

Insert table 3

Patterns of change between measures I and II

The Percentage Agreement between median NRS from *measure I*, the group of 4–9 ratings, and average NRS from *measure II* was 27% at rest and 26% on activity. Additional sub-group analyses of patients who had 5–9 and 6–9 registered pain ratings resulted in improvements up to 31%. Table 4 a and b, illustrates, in the areas above the diagonals, that the majority of patients recalled higher pain scores both at rest and on activity than they had stated to the nursing staff in measure I. The areas below the diagonals depict the opposite. Figure 2 shows the cumulative distribution of the calculated medians from patients' self-rated pain in *measure I* and the cumulative distribution of retrospective self-rated average pain; *measure II*. The cumulative distribution visualizes that the majority of patients who obtained a median of NRS 0 in *measure I* stated a higher average score in *measure II*. Another finding seen in the cumulative distributions, mainly applied to activity, was the larger proportion of patients who recalled severe pain in *measure II* than was stated in *measure I*.

At rest the systematic group changes towards higher pain scores at the second measure were significant (Relative Position: 0.18, Confidence Interval: 0.13-0.24), yet the Relative

Concentration showed no concentration to a certain score on the NRS (0.06, CI:-0.01–0.13). Additionally, the individual variation was within the expected outcome (Relative Rank Variation: 0.18, C I: 0.13–0.22). *On activity* there was no significant change in either direction (Relative Position: -0.09, CI: -0.14–0.05) and the Relative Concentration showed no concentration (-0.06, CI: -0.14–0.03). Additionally, the individual variation was close to the expected outcome (Relative Rank Variation: 0.23, CI: 0.16–0.29). These results imply that both systematic (group) and individual variations in reported pain caused disagreements between the two measures *at rest*, while individual variations were the main source of disagreements *on activity*.

Insert table 4

Discussion

The results demonstrate acceptable reliability for daily median measures of postoperative pain both at rest and on activity on the day after surgery. A low risk of obtaining values that represent more pain than was recalled applied particularly to pain at rest. Furthermore, our results exposed a tendency towards higher correlation coefficients of patients' retrospective stated pain with more frequent pain ratings. However, a range of 4–9 “right now” self-rated NRS pain scores seems appropriate for the calculation of median pain at rest and on activity. The choice of distinguishing pain at rest from pain on activity was based on patients' descriptions of healthcare professionals doing this only occasionally when asking for pain scores (Eriksson *et al.* 2014).

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It is recommended that the frequency of screening for pain, and reassessments, be determined by the duration and severity of pain (Gordon *et al.* 2010). In the early postoperative phase, this study shows frequent assessments to be necessary regardless of patients' reports of their level of pain. The median scores of 0 obtained by identified patients whose retrospective stated average pain was more than 0 could be attributed to healthcare professionals' performances when assessing pain. There is a possibility that nurses have registered NRS 0 when patients neglect pain, which means that precautions must be taken to obtain medians of 0. The neglect of pain due to tolerance (Jacobsen *et al.* 2009, Wikström *et al.* 2014) and fears related to analgesia are well known (Jacobsen *et al.* 2009, Wikström *et al.* 2016), meaning that these patients require frequent high-quality pain assessments, and that healthcare professionals need to get to know patients' attitudes and behaviours (Klopper *et al.* 2006, Richards & Hubbert 2007, Wikström *et al.* 2016). In association with this study, no educational support was conducted. However, the continuing need for improvement in the quality of pain assessments (Gordon *et al.* 2008, Samuels & Eckhardt 2014) is confirmed.

The individual variation in retrospective pain identified in the study could be explained by memory disorders (Khoshnejad *et al.* 2014). Also, the conversion of pain intensity into an average measure may vary due to the fluctuating nature of postoperative pain (Armstrong 2003, Bergh *et al.* 2005). The stability of the definition of worst-possible pain over short time-frames has to our knowledge not been studied in a clinical context. However, the scattered pattern of the pairs on activity in relation to the diagonal (Table 4b), may illustrate the difficulties of defining a stable perception of worst-possible pain, as pain at activity may represent worst-possible pain.

The unexpectedly small differences ($r=.61-.68$) in the correlational relationship between measure I and II with increasing numbers of pain scores could be attributed to the low proportion of patients who had their pain recorded in between every fourth hour, i.e. >5 times. The omission of documentation of breakthrough pain and reassessments has been reported before (Carr *et al.* 2014, Fletcher *et al.* 2008, Samuels & Eckardt 2014). Yet healthcare professionals state that the benefits of following patients' postoperative pain scores over time outweigh the difficulties of interpreting patients' scoring (Wikström *et al.* 2014, Wikström *et al.* 2016). However, nurses have the main role in pain management and are observed to take on the role of gatekeeper, defending the patient's view at times when physicians decide on medication without considering the patient's perspective (Manias *et al.* 2016). Daily documentation of the median measures would instead secure the patients' "voice" by demonstrating their experiences as the quality of documentation of patients' pain in medical records impacts upon both healthcare professionals and patients. Busy healthcare professionals are not always able to access required information in a timely manner. This consequently causes delays in treatment and at times inadequate care (Braaf *et al.* 2015; Wikström *et al.* 2016), which have been shown to affect both pain management (Meissner *et al.* 2015) and patient satisfaction (Schwenkglenks *et al.* 2014). The use of electronic systems is described as allowing for new innovations enhancing patient safety, i.e. providing accurate pain descriptions (Carr *et al.* 2014). Future computer-calculated measures, i.e. medians at rest and on activity, from patients' postoperative pain scores could possibly be a solution to improve daily documentation of pain in medical records.

Daily median values also offer an alternative to creating individual pain trajectories of both initial- and the resolution of pain in the first postoperative days. Persistently high pain scores should initiate reassessment of the origin of pain and the exclusion of surgical complications

(Meissner *et al.* 2015, Stubhaug & Breivik 2007, Wikström *et al.* 2016). Additionally, the significantly higher pain levels on activity confirm the relevance of measuring pain both at rest and on activity, which means that earlier recommendations by Wikström *et al.* (2013) of the documentation of mode and maximum pain in medical records can be questioned. High pain scores also have great potential for predicting chronic pain conditions (Althaus *et al.* 2014). Furthermore, it has been suggested that daily summarised pain scores could be useful when it is necessary to compare the organisational effectiveness of pain management between care settings (Samuels & Eckhart 2014). However, the need for defining “high pain scores” is discussed (Hjermstad *et al.* 2011). Postoperative pain scores >6 are for many patients unbearable, and could tentatively serve as a relevant cut-off point, as the titrating of opioids safely is a complicating factor when cut-off points are low (van Dijk *et al.* 2012).

Conclusion

Taking into account that self-rated pain with the NRS is not an exact measure, we conclude that the median values at rest and during activity are applicable daily measures when documenting postoperative pain in medical records. A range of 4–9 pain scores seems to be appropriate for the calculation of the measures, which highlights earlier recommendations regarding frequent screening and reassessments with the NRS. In all, there seems to be a low risk of obtaining a higher value than was recalled by patients. High-quality pain assessments, i.e. a thorough clinical investigation of patients’ individual perception of pain scores and the effects of pain management determine usability. Additionally, adjusting the frequency of pain assessments to patients’ needs (pain severity), attitudes (fears) and behaviours (anxiety) strengthens applicability.

Relevance to clinical practice

An assessment process where the patients get involved as an active participant is described as essential to achieve understanding of patients' pain experience. The documenting of daily median pain scores both at rest and during activity could if placed accessible in medical records for all healthcare professionals (nurses, enrolled nurses and physicians) constitute the basis in clinical decisions. The perception of pain is however shown to be highly individual. Variations are associated with disease characteristics such as pre-operative pain, which consequently means that there are obvious risks associated with decisions solely based on pain ratings and cut-off scores. This means that the obtaining of patients' narratives of how their pain affects their recovery is most important.

By showing patients postoperative pain severity trajectories in documentation of pain, the measures could also be an important key to predicting postoperative health-related consequences such as the development of postoperative chronic pain. However, postsurgical stays in hospital has become very short, suggesting that patients pain scores should be collected the first days after returning home. To explore the contributions to clinical pain management decisions with these simple, understandable and accessible measures of pain, based on patients' self-rated pain scores, needs further research from a healthcare as well as a patient perspective.

Limitations

One limitation was that the design entailed a risk of measurement error in measure II due to the collection of patients' retrospective pain scores. It is known that memory of pain is associated with individual sensory-affective and psychological factors (Khoshnejad *et al.* 2014), which are highly applicable to postoperative situations. Experiences such as worries and tiredness have been shown to impact on memory capacity (Khoshnejad *et al.* 2014). A short time-frame was therefore used between the measures.

Another limitation was in the collection of data. Few patients were asked to rate their pain more than every fourth hour, which consequently means that incidences of breakthrough pain could have been missed. However, the amount of data allowed for the exclusion of patients who had few documented pain scores in measure I. Median scores based on less than four ratings were deemed not applicable for analysis due to the dynamic nature of pain (Armstrong 2003).

A threat to internal validity is that the assessment of symptoms such as pain depends on individual variations, which means that exact scoring is not possible (Armstrong 2003, Svensson 2001, Wolrich *et al.* 2014). However, the chosen scale, NRS, is thoroughly validated and is considered reliable in descriptions of pain intensity (Hjermstad *et al.* 2014, Williamson & Hoggart 2005). Because of the subjective impact from symptoms on NRS-scoring, in this case pain the statistical rationale was based on the perspective that self-rated pain scores represented by numerical data should be treated as ordinal data. The choice of using only non-parametric statistical methods is supported by Svensson (2001). The Svensson method (Advic *et al.* 2010) contributed an understanding of both systematic and individual impacts on discrepancies identified between the two measures.

Acknowledgements

The authors thank the Academy for Health Care County Council of Jönköping, Sweden, and the Research Council of Southeast Sweden (FORSS) which have supported us financially. We are also grateful to all patients who agreed to share their experiences and the research nurses who gave up their time to collect data in this study.

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Table 1: Socio-demographic and clinical data

	Total n=479		General surgery n=190		Orthopaedic Surgery n=289		p- value
Age, mean, [range]	65.2 [22-93]		65.6 [23-93]		65.0 [22-92]		.89 ^a
Women, n (%)	211	(44.1)	54	(28.4)	157	(54.3)	<.001 ^b
Country of birth (%)							.76 ^b
Sweden	451	(94.4)	177	(93.2)	274	(94.8)	
Other	27	(5.6)	13	(6.8)	14	(4.8)	
Pre-hospital pain at rest, md (q1-q3)	2	(0-5)	0	(0-2)	4	(2-6)	<.001 ^a
Pre-hospital pain on activity, md (q1-q3)	6	(1-8)	0	(0-2)	7	(6-8)	<.001 ^a
Daily intake of analgesia six months prior to surgery, n (%)							
Non opioids ^d	136	(28.6)	14	(7.4)	122	(42.2)	<.001 ^b
Opioids ^e	66	(13.9)	9	(4.8)	57	(19.9)	<.001 ^b
Type of surgery, n (%)							
Cystectomy and nephrectomy	22	(4.6)	22	(11.6)	-		n/a
Prostatectomy	67	(14.0)	67	(35.3)	-		n/a
Other urology	4	(0.8)	4	(2.1)	-		n/a
Lower abdominal surgery	89	(18.6)	90	(47.4)	-		n/a
Vascular	6	(1.3)	6	(3.2)	-		n/a
Other general surgery	2	(0.4)	1	(0.5)	-		n/a
Knee replacement	76	(15.9)	-		76	(26.3)	n/a
Hip replacement	149	(31.1)	-		149	(51.6)	n/a
Neck and back	49	(10.2)	-		49	(17.0)	n/a
Other orthopaedic surgery	15	(3.1)	-		15	(5.2)	n/a
ASA ^c n (%)							.76 ^a
I	143	(30.6)	58	(32.0)	85	(29.7)	
II	264	(56.5)	99	(54.7)	165	(57.7)	
III	59	(12.6)	23	(12.7)	36	(12.6)	
IV	1	(0.2)	1	(0.5)	-	-	
Anaesthesia, n (%)							
Regional	245	(51.1)	47	(24.7)	198	(68.5)	<.001 ^b
Sedation	167	(34.9)	3	(1.6)	164	(56.7)	<.001 ^b
General	267	(55.7)	172	(90.5)	95	(32.9)	<.001 ^b
Postoperative analgesia n (%)							
Opioids ^f	362	(77.5)	90	(49.2)	272	(95.8)	<.001 ^b
Epidural	120	(25.5)	105	(57.4)	15	(5.2)	<.001 ^b

^a Mann-Whitney U test, ^b Pearson Chi-square test, ^c ASA, American Society of Anesthesiologists physical status classification, n/a, non-applicable, ^dNon-opioids: paracetamol, NSAIDs, ^eOpioids: codeine, tramadol, morphine, oxycodone, fentanyl, buprenorfin, ^fOpioids: tramadol, morphine, oxycodone

Table2: Frequency of patients' self-rated pain, measure I

Number of pain ratings	Total n (%) n=479	
	at rest	on activity
0-3	85 (18.4)	119 (24.8)
4	139(29.0)	150(31.3)
5	116(24.2)	101 (21.1)
6	96(20.0)	67 (14.0)
7	35(7.3)	33 (7)
8	7(1.5)	7 (1.5)
9	1(0.2)	2 (0.4)

Table 3: Spearman rank correlations between individual median scores from measure I, using the four created groups; patients with 4, 4–9, 5–9, 6–9 ratings versus retrospective average pain from measure II, pain at rest and on activity

Number of pain ratings	4 ^a n=139	4–9 n=394	5–9 n=255	6–9 n=139
Average pain at rest	.61**	.64**	.67**	.68**
Average pain on activity	.57**	.64**	.66**	.62**

^a Patients with exactly four self-ratings of pain**Table 4:**

a. Contingency table illustrating the distribution of the paired-ordered categorical data from measures I and II at rest, using the group of patients with 4-9 NRS ratings, (n=388)

		Median NRS pain scores at rest, measure I											n
Average NRS pain scores at rest, measure II	NRS	0	1	2	3	4	5	6	7	8	9	10	
	10									1	1		2
	9				1	2	1						4
	8			2	2	4	2	3	1				14
	7	1		1	2	4	4	2	1	1			16
	6	4	1	3	2	9	4	4	1				28
	5	6	2	2	9	11	13	5	2	1			51
	4	7	10	7	18	7	4	1					54
	3	13	9	10	16	8	3		1	1			61
	2	22	14	23	10	2	1						72
	1	26	15	6	3		1						51
	0	27	6	1	1								35
n		106	57	55	64	47	33	15	6	4	1	0	n=388

b. Contingency table illustrating the distribution of the paired-ordered categorical data from measures I and II on activity, using the group of patients with 4-9 NRS ratings, (n=351)

	Median NRS pain scores on activity, measure I												n
	NRS	0	1	2	3	4	5	6	7	8	9	10	
Average NRS pain scores on activity, measure II	10			1			1	2	1	2	1		8
	9	1			1	1		4	8	9	3		27
	8	1	2	1	6	1	9	10	11	9			50
	7	2		1	3	6	6	9	6	2	1		36
	6		1	1	8	6	7	6	4	4			37
	5	2	2	3	5	16	14	5	4	2			53
	4	6	1	6	8	13	5	1	1			1	42
	3	4	1	5	12	8	2	2	1	2		1	38
	2	5	7	17	6	2				1			38
	1	5	3		1	1		1					11
	0	10	1										11
	n	36	18	35	50	54	44	40	36	31	5	2	n=351

Figure1: Flowchart of patients and data collection

Figure 2: Cumulative distribution % of self-estimated pain at rest (n=388) and during activity (n=351) with the NRS, illustrating the paired- ordered categorical data from measures I and II with 4-9 NRS ratings.