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Mild, Moderate and Severe Pain in Patients Recovering from Major Abdominal Surgery

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Abstract

Pain interferes with various activities such as coughing, deep breathing and ambulation designed to promote recovery and prevent complications after surgery. Determining appropriate cutpoints for mild, moderate and severe pain is important since specific interventions may be based upon this classification. The purpose of this research was to determine optimal cutpoints for postoperative patients based upon their worst and average pain during hospitalization and after discharge to home, and whether the optimal cutpoints distinguished patients with mild, moderate or severe pain with respect to patient outcomes. This secondary analysis consisted of 192 postoperative patients aged 60 years and over. Multivariate analyses of variance (MANOVAs) were used to stratify the sample into mild, moderate and severe pain groups using eight cutpoint models for worst and average pain in the last 24 hours. One-way analyses of variance were conducted to determine whether patients experiencing mild, moderate or severe pain were different in outcomes. Optimal cutpoints were similar to those previously reported with the boundary between mild and moderate pain ranging between 3 and 4, and the boundary between moderate and severe pain ranging between 5 and 7. Worst pain cutpoints were most useful in distinguishing patients with regard to fatigue, depression, pain's interference with function, and morphine equivalent administered in the previous 24 hours. A substantial proportion of patients experienced moderate to severe pain. The results suggest a narrow boundary between mild and severe pain that interferes with function. The findings indicate that clinicians should seek to aggressively manage postoperative pain ratings greater than 3.

Keywords

postoperative pain; cutpoints for pain severity; pain interference; abdominal surgery

Pain interferes with various activities such as coughing, deep breathing, turning, and ambulation that are designed to prevent complications and promote recovery after surgery. Despite the establishment of clinical guidelines for pain management (Gordon et al., 2005), and Joint Commission standards (Joint Commission, 2012), moderate to severe pain after major surgery persists with the incidence ranging from 29.6 to 86% % (Apfelbaum, Chen,

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Mehta, & Gan, 2003; Dolin, Cashman, & Bland, 2002; Herrick et al., 2004; Hutchison, 2007; McGrath et al., 2004; Sauaia et al., 2005).

Since clinicians and patients frequently use verbal descriptors in communicating about pain, and patients are asked to provide a numerical rating of pain, determining cutpoints, or what numbers correspond to which verbal descriptors (mild, moderate or severe), can be valuable in assessing changes in pain, reducing the number of patients who experience moderate or severe pain and evaluating pain's effect on function and quality of life parameters. Serlin and colleagues categorized pain as mild, moderate or severe based on pain's interference with function in patients with cancer (Serlin, Mendoza, Nakamura, Edwards, & Cleeland, 1995). Cutpoints (CP) were found to be 4 and 6 on a 0 to 10 numerical scale based upon pain's interference with function and thus, a rating of 1-4 was indicative of mild pain, 5-6 indicated moderate pain and 7-10 indicated severe pain (Serlin et al. 1995) Patients with different diagnoses such as neck pain, general pain, osteoarthritis, diabetic neuropathy and cancer pain as well as community dwelling adults recalling a painful experience have different cutpoints for mild, moderate and severe pain (Fejer, Jordan, & Hartvigsen, 2005; Hoffman, Sadosky, Dukes, & Alvir, 2010; Kapstad, Hanestad, Langeland, Rustoen, & Stavem, 2008; Palos, Mendoza, Mobley, Cantor, & Cleeland, 2006; Serlin et al., 1995; Zelman, Hoffman, Seifeldin, & Dukes, 2003). Cutpoints have generally been found to be between 1 and 3-4 for mild pain; ranging between 4-5 to 6-7 for moderate pain and ranging from 6-8 to 10 for severe pain (See Table 1).

Two studies examined cutpoints for surgical patients. Mendoza et al. (2004) using the patient's worst pain in the last 24 hours, reported results of 1-4 for mild pain, 5-6 for moderate pain and 7-10 for severe pain for patients who had coronary artery bypass surgery (CABG) (N = 462). Using this categorization, 18% of patients reported moderate pain and 14% reported severe pain after the third postoperative day. Dihle, Helseth, Paul and Miaskowski (2006) calculated 4 sets of cutpoints for patients who had hip and knee surgery (N = 176) with the first number in parentheses being the upper limit of mild pain and the second number being the upper limit of moderate pain: average pain (CP 4,5), worst pain (CP 4,7), the mean of average and worst pain (CP 3,5), and the mean of average, worst and current pain (CP 3,5) finding that for pain ratings greater than 3, there was a significant effect on general activity, mood, walking ability and sleep. The variations in cutpoints obtained by Mendoza et al. and Dihle et al. may be due to variation in whether the worst, average or current pain was used as well as differences in pain experienced by individuals with different clinical conditions.

Researchers have not, to date, examined pain cutpoints in patients with major abdominal surgery who have transitioned from acute care to home or the relationship of pain categorizations to important outcomes that may influence recovery such as fatigue, depression and functional status. Coronary artery bypass and joint replacement surgeries only represent a fraction of the surgical patient population. Having a common understanding of the impact of mild, moderate and severe pain across populations and settings would enhance clinicians' abilities to provide effective pain relief. This investigation was designed to determine (1) optimal cutpoints for older adults recovering from major abdominal surgery based upon patients' worst and average pain during hospitalization and 3-5 days after

discharge to home, (2) the proportion of patients experiencing mild, moderate and severe pain based upon the cutpoint analyses, and (3) whether the optimal cutpoints distinguish patients with mild, moderate or severe pain with respect to pain's interference with function, fatigue, depression, morphine equivalents administered, and functional status.

Materials and Methods

Sample and Procedures

This is a secondary analysis of data from a descriptive study that examined pain, fatigue and depression in relation to functional status and self-perception of recovery in patients who had major abdominal surgery (Zalon, 2004). The sample consisted of 192 patients, aged 60 years and older recruited from 3 community hospitals after having their surgery. Of those, 169 patients completed all items of the instruments during an initial interview during hospitalization and 137 completed all items of the instruments 3-5 days after discharge from the hospital. Patients whose surgery was related to a primary diagnosis of cancer were excluded in the original study because it was thought that this might be an added factor that would complicate recovery in this longitudinal study. The original study received Institutional Review Board approval at each hospital and the author's university. The latter also approved this secondary analysis. Details of the original study are described elsewhere (Zalon, 2004). Written informed consent was obtained at least 24 hours postoperatively at a time the patient was resting comfortably. The initial face-to-face interview was usually conducted at the time consent was obtained and the second interview was conducted at a mutually agreeable time by telephone appointment 3 to 5 days after discharge to home.

Measures

Patients answered demographic questions and completed the Brief Pain Inventory (BPI) (Daut, Cleeland, & Flanery, 1983), Geriatric Depression Scale Short-Form (GDS-SF) (Sheikh & Yesavage, 1986), and the Modified Fatigue Symptom Checklist (MFSC) (Pugh, 1993) while hospitalized and again after discharge to home. Information about opioid analgesics administered for the 24 hours prior to completion of the first interview were obtained from the medical record.

Brief Pain Inventory (BPI)—Patients rated their pain using the BPI (Daut et al., 1983). This tool includes 4 ratings of pain's intensity on a 0 to 10 numerical scale (worst, least, average in last 24 hours and present pain) for *no pain to pain as bad as you can imagine*, and 7 ratings of pain's interference with function (general activity, mood, walking, work, relationships with other people, sleep and enjoyment of life) again rated on a 0 to 10 numerical scale for *does not interfere to completely interferes*. The worst and average pain intensity scores of the BPI were used for this analysis. The 7 BPI interference items were summed, thus scores can range from 0 to 70. The BPI has well-established reliability and validity in patients with chronic pain and cancer pain (Keller et al., 2004; Serlin et al., 1995), as well as samples of surgical patients (Dihle et al., 2006; Mendoza et al., 2004; Zalon, 2004).

Modified Fatigue Symptom Checklist—The MFSC developed by Yoshitake (1971), and as modified by Pugh (1993), has 30 items using a 4-point Likert scale measuring fatigue from a multidimensional perspective (drowsiness, concentration and physical symptoms). Scores are summed and range from 30 to 120. The MFSC has established reliability (Pugh, 1993; Zalon, 2004), and is significantly correlated with a single item VAS for fatigue (Bozoky & Corwin, 2002).

Geriatric Depression Scale-Short Form—The Geriatric Depression Scale-Short Form is a widely used depression scale that specifically measures depression in a geriatric population (Sheikh & Yesavage, 1986). It is highly correlated with clinical depression (Wall, Lichtenberg, MacNeill, Walsh, & Deshpande, 1999), and has demonstrated validity in a variety of patient populations (Pedraza, Dotson, Willis, Graff-Radford, & Lucas, 2009). The short form of the GDS consists of 15 items in a yes-no format (Sheikh & Yesavage, 1986). Scoring was accomplished by reversing the negative items, and then totaling the items indicating depression resulting in a range of scores from 0 to 15.

Morphine Equivalent Analgesics Administered—Opioid analgesics administered were converted to parenteral morphine equivalents. The total equivalent of morphine administered was calculated for the 24 hours prior to the completion of the BPI while patients were hospitalized using an equianalgesic table (McCaffery & Pasero, 1999).

Statistical analyses

Descriptive statistics were used to describe the patients' demographic characteristics. The creation of cutpoints replicated the methodology developed by Serlin et al. (1995). Cutpoints based upon the BPI's 0 to 10 numerical scale for the worst pain in the last 24 hours were used to determine where the largest differences were among patients experiencing mild, moderate or severe pain. Serlin et al. used multivariate analysis of variance (MANOVA) to determine which of the categorical variables demonstrated the largest differences between the groups with regard to pain's interference with function. Cutpoints for this investigation were created by dividing patients into three groups: those having mild, moderate or severe pain. Eight categorical variables were created for all the possible cutpoints between 3 and 7 for the worst pain and average pain during hospitalization and the worst and average pain 3-5 days after discharge (see Table 2). For example, the cutpoint variable CP 47 is coded so that the two numbers represent the upper limit of the mild and moderate pain categories. Thus, for CP 47, a pain intensity rating of 1-4 corresponds to mild pain, 5 to 7 corresponds to moderate pain and 8-10 corresponds to severe pain. Each cutpoint variable was related to the BPI pain interference subscale (general activity, mood, walking, work, sleep, relationships with others and enjoyment of life) using MANOVAs. Thus, this analysis is used to determine where the biggest differences among the eight different cutpoint categorizations for mild, moderate and severe pain were with respect to pain's interference with function. Specifically, the optimal set of cutpoints for mild, moderate and severe pain was the MANOVA that yielded the largest *F* ratio between the categories as indicated with Pillai's trace, Wilks' lambda and Hotelling's trace *F* statistics.

Descriptive statistics were used to describe the portion of the sample experiencing mild, moderate and severe pain. One-way ANOVAs were performed with the optimal set of cutpoint variables to determine whether there were differences among patients with mild, moderate or severe pain with regard to fatigue, depression, pain's interference with function, and total equivalent morphine dose administered in the previous 24 hours during hospitalization, and then fatigue, depression, pain's interference with function, and functional status 3 to 5 days after discharge. Analyses of variance (ANOVAs) and chi-square analyses were performed with the optimal cutpoints obtained for mild, moderate and severe pain to determine whether there were differences in the sample characteristics. No imputation was done for missing data. SPSS Statistics 17.0 (SPSS Inc., Chicago, IL) was used for statistical analyses.

Results

Sample characteristics

The sample consisted of 192 patients drawn from 3 community hospitals whose ages ranged from 60 to 87 years, with a mean of 71.2 years ($SD = 6.8$). The sample was comprised of 90 (46.9%) males and 102 (53.1 %) females and was primarily non-Hispanic white (99.5%). Types of surgery included abdominal aortic aneurysm repair (26.6%), colon resection (22.4%), cholecystectomy (18.2%), appendectomy (5.7%), hysterectomy (3.6%) and other (23%). A chronic painful condition was reported by 59.2% of the participants, most commonly arthritis. Following discharge, 39.2% of the patients received home care services.

Determination of cutpoints

MANOVAs were performed for worst pain and average pain in the last 24 hours once during hospitalization and then for worst and average pain in the last 24 hours 3-5 days after discharge. The results of the MANOVAs performed for worst pain and average pain with pain's interference with function during hospitalization are reported in Table 3. Cutpoints with the highest overall effect on the BPI's pain interference items for worst pain during hospitalization were 3,5 corresponding to 1-3 for mild pain, 4-5 for moderate pain and 6-10 for severe pain. The cutpoint with the highest overall effect on the BPI's pain interference subscale for average pain during hospitalization was 4,5 (see Table 3). For worst pain 3-5 days after discharge, the cutpoint with the highest overall effect on the BPI's pain interference items was 4,6 (see Table 4). For 3-5 days after discharge, there were mixed results for average pain; the cutpoint with the largest F ratio for Pillai's trace was 4,5 and the cutpoint for the largest F ratio for Wilks' lambda and Hotelling's trace was 4,7 (see Table 4).

Proportion of patients experiencing mild, moderate and severe pain

The proportion of patients in the sample who experienced mild pain, moderate pain and severe pain as determined by the cutpoint for average pain and worst pain having the highest overall effect on the BPI interference subscale, as well as those who had no pain is reported in Table 5. The results indicate that for 73.7% of the patients in the original sample, their worst pain was in the moderate to severe categories, and for 36.5% of the patients, their average pain was in the moderate to severe categories while hospitalized. These percentages were substantially lower 3-5 days after discharge with 29.1% of the patients experiencing

their worst pain and 14.9% experiencing their average pain in the moderate to severe categories.

The means and standard deviations for the interference items of the BPI when the worst and average pain are classified as mild, moderate or severe according to the cutpoint that had the highest effect on the BPI interference items are included in Table 5. The cutpoint 4,7 was used for average pain for 3-5 days after discharge. These results indicate that for patients experiencing their worst or average pain in the moderate category, pain had greater interference with function than those who experienced their worst or average pain in the mild category. Similarly, for patients experiencing their worst or average pain in the severe category, pain had greater interference with function than those who experienced their worst or average pain in the moderate category. As pain intensity ratings increased, the mean pain interference score increased as well (See Figure 1).

Differences in outcomes according to pain severity

Using the optimal cutpoint for worst pain (CP 35) and average pain (CP 46) during hospitalization, ANOVAs indicated there were significant differences among patients having mild, moderate or severe pain with regard to depressive symptoms, total morphine equivalent medication administered in the previous 24 hours, and pain's interference with function (see Table 6). However, for fatigue, the differences were significant only for the worst pain during hospitalization. Using the optimal cutpoint for worst pain (CP 46) for 3-5 days after discharge, ANOVAs indicated there were significant differences among patients having mild, moderate or severe pain with regard to pain's interference with function, fatigue and depressive symptoms (See Table 7). For the optimal cutpoint for average pain (CP 47), ANOVAs indicated there were significant differences with regard to pain's interference with function, but not fatigue and depressive symptoms. The patients in the severe group for the average pain cutpoint (CP 47) had a lower mean for pain's interference with function than the mild or moderate groups (See Table 7).

Ancillary analyses

An ANOVA using the optimal cutpoints obtained indicated that there were no differences among patients having mild, moderate or severe pain with regard to age. Chi-square analysis indicated there were no differences among patients having mild, moderate or severe pain with regard to type of surgery. However, with regard to gender when using the optimal cutpoints obtained, chi-square analyses indicated that there were significant differences between men and women for worst pain (CP 35) and average pain (CP 46) during hospitalization ($\chi^2 = 9.12$, $df = 2$, $p = .01$; $\chi^2 = 12.23$, $df = 2$, $p = .002$), but not for worst pain (CP 46) or average pain (CP 47) 3 to 5 days after discharge. Inspection of the results indicates a higher percentage of women experienced moderate and severe pain in comparison to men while hospitalized.

Discussion

This study established cutpoints for mild, moderate and severe pain in a sample of adults age 60 years and older recovering from major abdominal surgery while hospitalized and 3 to 5

days after discharge to home. The cutpoints in this investigation are similar to those reported in other samples (see Table 1). The cutpoints for this sample varied. The worst pain cutpoint for hospitalization was CP 35 and for 3-5 days after discharge, it was CP 46, and the average pain cutpoint for hospitalization was CP 45 and for 3-5 days after discharge, it was CP47. The results for the of MANOVAs for average pain 3 to 5 days after discharge resulted in F ratios that were very similar for Pillai's trace, Wilk's lambda and Hotelling's trace for CP 45, CP 46 and CP47 indicating that this might be a function of patient population and/or sample size. The optimal cutpoints for both average and worst pain were higher after discharge to home. These results may have been due to the nature of postoperative pain in that it usually decreases over time (Mendoza et al., 2004; Milgrom et al., 2004; Zalon, 2004)

This study yielded similar findings to other studies that examined cutpoints for mild, moderate and severe pain in surgical patients. Mendoza et al.'s (2004) optimal cutpoint for patients having CABG surgery using the worst pain was CP 46 for 5 of 11 days. However, cutpoints of CP 36 and CP 37 were optimal on 3 days each. Dihle et al.'s (2006) optimal cutpoints for patients having hip or knee surgery: worst pain (CP 47), average pain (CP 45), mean of worst and average pain (CP 35) and mean of worst, average and current pain (CP 35) were similar. The findings of the present investigation along with those of Mendoza et al. and Dihle et al. suggest absolute cutpoint values may not be fixed, but rather vary with the population.

The present sample was one of relatively healthy patients aged 60 years and older who were discharged directly to home. Dihle et al.'s (2006) sample consisted of patients who had hip or knee replacement surgery, and Mendoza et al.'s (2004) sample consisted of patients who had CABG surgery, which could account for differences in activities after surgery, and thus, pain's interference with function. Patients having hip and knee surgery might have more difficulty in walking than patients recovering from CABG or abdominal surgery. The effectiveness of pain medication and how it might influence patients' responses to the interference items is not known. Patients who have difficulty in walking due to pain may take an analgesic prior to engaging in that activity. Since the present sample consisted of older adults, they may have had a higher incidence of chronic painful conditions in comparison to other surgical samples. However, incidence of chronic pain in Dihle et al.'s sample was 75%, whereas in the current sample it was lower, 59.2%.

As more time elapses since surgery, the cutpoints for mild, moderate and severe pain may be higher as illustrated by the differences between the optimal cutpoints during hospitalization and after discharge in this sample. This is consistent with the decrease in mean pain interference scores in the Mendoza et al. study (2004). Furthermore, the results of this investigation indicate there is a nonlinear relationship between the severity of pain and its interference with function (See Figure 1). Specifically, the pain interference scores rise more sharply when pain intensity ranges between 3 and 5, particularly for average pain. The variation in pain's interference with function at the higher intensities could be a function of greater variation in the sample because fewer patients would be experiencing more extreme pain as they recover from surgery. Regardless, the border between mild and moderate pain is generally between 3 and 4 and the border between moderate and severe pain ranges between 5 and 7 suggesting a narrower boundary between mild and severe pain that interferes with

function. When the average pain intensity is higher, it has a greater interference with function. When surgical patients experience more severe pain that is their worst pain, it is likely that they would postpone activities until the pain dissipates. However, when their average pain is moderate or severe, it becomes more difficult to do so.

Researchers have generally used worst and average pain to determine cutpoints (Dihle et al., 2006; Paul et al., 2005; Serlin et al., 1995). Li, Harris, Hadi and Chow (2007) recommended using worst pain in patients with bone metastases because worst pain yielded the largest F ratios. In the present investigation, the F ratios obtained for worst and average pain during hospitalization were similar, but for 3 to 5 days after discharge the F ratios were higher for worst pain (See Tables 3 & 4). However, in this investigation, the mean pain interference ratings were higher for average pain than worst pain during hospitalization and also after discharge (See Figure 1). Dihle et al. (2006) recommended using the mean of the average and worst intensity rating to determine cutpoints for mild, moderate and severe pain. However, the most discriminating cutpoint for Dihle et al.'s calculation was CP 35, the same cutpoint for the worst pain during hospitalization for the present study. The differences in cutpoints may be a function of not only the patient population, but also the timing of data collection as well as sample size. Since the boundaries for the cutpoints are similar across different studies (see Table 1), particularly for those including surgical patients (Dihle et al.; Mendoza et al., 2004), it is recommended that clinicians aggressively manage pain when patients rate their worst or average pain above a 3 and incorporate this recommendation into patient teaching.

For a significant proportion of patients in this sample, their worst pain (73.6%) and average pain (36.5%) was in the moderate to severe range during hospitalization. Although the proportion of patients experiencing moderate to severe pain was lower 3 to 5 days after discharge as would be expected, for 29.1% of the patients their worst pain was in the moderate to severe range and for 14.9% their average pain was in the moderate to severe range. These results indicate that unrelieved pain continues to be problematic in acute care settings and continues as patients are discharged to home. These results raise questions about the adequacy of postoperative pain management in the acute care setting and whether patients are being provided with sufficient education to manage their pain at home following discharge. Postoperative pain severity is predictive of pain after discharge and is a risk factor for the development of chronic pain (Callesen, Bech, & Kehlet, 1999; Gottschalk & Ochroch, 2008; Poleshuck et al., 2006). The high percentage of patients experiencing moderate to severe pain indicates that efforts should be made to continue to improve the quality of pain management in surgical patients.

The optimal cutpoints differentiated patients with mild, moderate and severe pain for some of the outcome measures, but not all. The worst pain and average pain optimal cutpoints distinguished among the 3 groups of patients for depression, fatigue, and pain's interference with function during hospitalization. These results illustrate the global effect of pain on patient outcomes. Thus, improvement in pain management with an effort to bring worst and average pain scores to 3 or less for hospitalized patients might result in overall improvement in function and a more rapid recovery. The worst pain optimal cutpoint did distinguish among the three pain severity groups with regard to fatigue and depression 3 to 5 days after

discharge indicating that moderate and severe pain was associated with more fatigue and depressive symptoms and that association persisted after discharge. Patients discharged to home may have less support to carry out daily activities than while in the hospital. Only 39.2% of the patients in this sample received home care services. Patients might not have had a caregiver to provide assistance and encouragement at home to engage in activities such as walking, changing position, coughing and deep breathing. While the differences in the means for fatigue and depressive symptoms were small, it is not known to what extent these are important differences clinically.

The average pain optimal cutpoint after discharge only differentiated the three pain severity groups for pain's interference with function. This set of cutpoints was higher (CP 47), and most patients (85.1%) had either no pain or mild pain on average. The lack of discrimination on outcomes indicates that average pain may be less useful when establishing cutpoints for mild, moderate or severe pain in discharged surgical patients because an increasing number of patients will report no pain or mild pain as time progresses. Paul et al. (2005) recommended that the use of average or worst pain to establish optimal cutpoints be based on the sample characteristics and the nature of the pain. Mendoza et al. (2004) recommend that clinical trials of postoperative pain control focus on patients with moderate to severe pain. Although, the percentage of patients with moderate and severe average pain decreased at 3 to 5 days after discharge, when considering the 27 million in-patient surgeries performed in the United States in an annual basis (US Census Bureau, 2010), the number of patients who potentially have pain that interferes with function is quite substantial and deserves action by clinicians in order to improve postoperative recovery.

Optimal cutpoints for average and worst pain during hospitalization also differentiated the total amount of morphine equivalents administered in the previous 24 hours with patients with moderate pain receiving more medication than those with mild pain, and patients with severe pain receiving more medication than those with moderate pain. Dihle et al. (2006) reported similar results in that patients with mild pain received a significantly lower total dose of opioid. This might suggest that medication administered for mild pain is more effective than the usual amount of medication administered for moderate and severe pain intensity levels. Despite the higher total morphine equivalent received, patients experiencing moderate and severe pain might not have received sufficient medication for pain relief or to improve outcomes for fatigue, depression and function. These results reinforce the long-standing recommendation to administer pain medication before it becomes more severe.

While the present sample consisted of older adults, age was not shown to be a factor related to the cutpoints. However, this could have been because all study participants were at least 60 years old. In two studies with surgical patients, no age differences were found (Dihle et al., 2006; Mendoza et al., 2004). However, in a third study, patients in the mild pain group were older than those with moderate pain (Kapstad et al., 2008). Studies with chronic pain populations also have mixed results with regard to age with some finding that the mild pain group tends to be older (Li et al., 2007), and others finding the age of the patients in the mild, moderate and severe groups are not significantly different (Fejer et al., 2005; Gagliese & Melzack, 2003). However, no study reported that the average age of patients in the severe category were older. What is not known whether older patients are more functionally

impaired at a mild level of pain than younger patients, thus making management of mild pain levels more critical for the older patient.

Significantly more women than men experienced moderate and severe levels of pain in this sample. This is consistent with previous research conducted with patients recovering from surgery (Aubrun, Salvi, Coriat, & Riou, 2005; Cepeda & Carr, 2003; Mattila, Toivonen, Janhunen, Rosenberg, & Hynynen, 2005; Parry et al., 2010; Singh & Lewallen, 2009; Watt-Watson et al., 2004). While there has been a tremendous growth of research in this area (Fillingim, King, Ribeiro-Dasilva, Rahim-Williams, & Riley, 2009), it is suggested that research focus on efforts to determine whether different strategies employed for men and women would improve clinical outcomes by decreasing the impact of postoperative pain on function.

Limitations included the homogenous sample in that the participants were 99.5% non-Hispanic white. It is not known to what extent the optimal cutpoints and effects on function are similar or different in different samples of surgical patients. A number of patients did not continue with the study after discharge. Patients experiencing greater pain after discharge might have been less likely to continue with the study, thus impacting the results. Patients were discharged directly to home. With pressures on hospitals to reduce costs and length of stay, many patients, particularly older patients are discharged to personal care homes, rehabilitation or long-term care facilities after surgery. There may be differences in these patients' pain as well as differences in certain outcomes. The small sample size is a limitation, but despite this, the cutpoints were similar to those found in other investigations. No studies of pain cutpoints to date have included patients who had their surgeries on an outpatient basis. It is not known to what extent the practices of these patients with regard to taking pain medication has an impact on their return to function. Replicating this research with a larger sample and patients across the broad spectrum of surgery is warranted in order to determine the extent to which pain interferes with function after discharge to home. Finally, directly asking patients whether their pain was mild, moderate or severe in addition to using the BPI would have provided another point of comparison that could have strengthened the findings.

In conclusion, this study provided information about the optimal cutpoints for mild, moderate and severe pain in patients who had abdominal surgery. There were variations in the optimal cutpoints for worst and average pain at different times in the postoperative period as well as differences in the ability of the cutpoints to distinguish among the patients having mild, moderate or severe pain with regard to functional outcomes. Based on these results and that a significant proportion of the patients in the sample were experiencing moderate to severe pain, it is recommended that the worst pain optimal cutpoint (CP 35) with ratings of 1 to 3 corresponding to mild pain, 4-5 corresponding to moderate pain, and 6-10 for severe pain be used by clinicians. It is further recommended that clinicians seek to aggressively manage pain ratings that are greater than a 3 regardless of whether it is the patient's worst or average pain.

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Figure 1.
Pain interference rating at each level of pain intensity for worst pain and average pain during hospitalization and 3-5 days after discharge.

Table 1

Research studies investigating cutpoints for pain ratings.

Authors	Sample	Pain Measure *	Cutpoints		
			Mild	Moderate	Severe
Dihle et al. 2006	Hip and knee replacement (N = 176)	Average	1-4	>4-5	>5-10
		Worst	1-4	>4-5	>7-10
		Worst & Average Mean	1-3	>3-5	>5-10
		Worst, Average and Now Mean	1-3	>3-5	>5-10
Fejer et al. 2005	Neck pain (N = 1385)	Average over 2 weeks	1-4	5-6	7-10
		Total over 2 weeks	1-4	5-6	7-10
		Worst in 2 weeks	1-4	5-7	8-10
		Pain in general over last 3 months	1-3	4-7	8-10
Hanley et al. 2006	Spinal cord injury with current pain (N = 307, 174)	Worst over last 3 months	1-3	4-6	7-10
Hoffman et al. 2010	Diabetic neuropathy (N = 401)	Average pain	1-3	4-6	7-10
Jensen et al. 2001	Lower limb amputation (N = 205)	Average low back pain over 3 months	1-4	5-6	7-10
		Average phantom limb pain over 3 months	1-4	5-7	8-10
		Average general pain over 3 months	1-3	5-6	7-10
		Average	1-4	4-6	6-10
Kapstad et al., 2009	Hip osteoarthritis (N = 224)	Average	1-4	4-7	7-10
Li et al. 2007	Knee osteoarthritis (N = 94)	Average	1-4	5-6	7-10
		Worst	1-4	5-6	7-10
		Average	1-4	5-6	7-10
		Current	1-2	3-6	7-10
Mendoza et al. 2004	Coronary artery bypass graft (N = 462)	Worst	1-3	5-6	7-10
Palos et al. 2006	Community dwelling adults (N = 287)	Recall of painful experience	1.3-3.6	4.3-6.5	7.4-9.8
Paul et al. 2005	Cancer with bone metastases (N = 160)	Worst	1-4	>4-7	>7-10
		Average	1-4	>4-7	>7-10
		Worst	1-4	5-6	7-10
		Average	1-5	>5-7	>7-10
Serlin et al. 1995	Cancer (N = 1,897)	Average	1-5	>5-8	>8-10
Zelman et al. 2003	Low back pain (N = 96)	Worst	0-3	4-6	7-10
		Average	0-3	4-6	7-10
		Worst	0-3	4-6	7-10
		Average	0-3	4-6	7-10

* Measures were either a 0-10 numerical rating scale, the pain intensity scales of the BPI, or the BPI for a specific patient populations.

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Table 2

Cutpoint variables.

Cutpoint	Mild	Moderate	Severe
CP 3,5	1-3	4-5	6-10
CP 3,6	1-3	4-6	7-10
CP 3,7	1-3	4-7	8-10
CP 4,5	1-4	5	6-10
CP 4,6	1-4	5-6	7-10
CP 4,7	1-4	5-7	8-10
CP 5,6	1-5	6	7-10
CP 5,7	1-5	6-7	8-10

Table 3
Results of MANOVAs for worst pain and average pain's interference with function during hospitalization.

Cutpoint	Worst Pain (n = 169)						Average Pain (n = 154)					
	Pillai's trace		Wilk's lambda		Hotelling's trace		Pillai's trace		Wilk's lambda		Hotelling's trace	
	Rank	F	Rank	F	Rank	F	Rank	F	Rank	F	Rank	F
35	1	3.738	1	4.019	1	4.301	4	3.135	4	3.251	4	3.366
36	3	3.620	6	3.385	3	4.049	7	2.521	6	2.614	6	2.705
37	2	3.698	2	3.957	2	4.215	5	2.665	5	2.724	5	2.782
45	6	3.293	4	3.495	4	3.695	1	4.250	1	4.478	1	4.705
46	8	3.174	8	3.327	8	3.480	3	3.860	3	4.136	3	4.412
47	5	3.296	5	3.470	5	3.644	2	4.094	2	4.358	2	4.621
56	4	3.416	3	3.499	6	3.581	8	2.226	8	2.299	8	2.372
57	7	3.227	7	3.365	7	3.502	6	2.543	7	2.598	7	2.652

Table 4

Results of MANOVAs for worst pain and average pain's interference with function 3-5 days after hospital discharge.

Cutpoint	Worst Pain (n = 108)						Average Pain (n = 94)					
	Pillai's trace		Wilk's lambda		Hotelling's trace		Pillai's trace		Wilk's lambda		Hotelling's trace	
	Rank	F	Rank	F	Rank	F	Rank	F	Rank	F	Rank	F
35	6	3.919	6	4.176	6	4.433	4	2.708	4	2.706	4	2.704
36	4	4.288	4	4.501	4	4.712	5	2.675	5	2.653	6	2.631
37	5	4.068	5	4.289	5	4.509	7	2.246	7	2.279	7	2.311
45	3	4.549	3	4.637	3	4.724	1	2.950	2	2.954	2	2.957
46	1	4.659	1	4.747	1	4.834	2	2.905	3	2.911	3	2.916
47	2	4.557	2	4.647	2	4.735	3	2.854	1	2.964	1	3.072
56	7	3.903	7	3.868	7	3.833	8	1.990	8	2.007	8	2.022
57	8	2.728	8	2.271	8	2.831	6	2.531	6	2.591	5	2.650

Table 5

Proportion of patients with none, mild, moderate or severe pain.

	Hospitalization		3-5 Days after Discharge	
	Worst (CP 35)	Average (CP 45)	Worst (CP 46)	Average (CP 47)
None	9 (4.7%)	24 (12.7%)	30 (21.3%)	44 (31.2%)
Mild	41 (21.6%)	96 (50.8%)	70 (49.6%)	76 (53.9%)
Moderate	62 (32.6%)	34 (18.0%)	28 (19.9%)	19 (13.5%)
Severe	78 (41.1%)	35 (18.5%)	13 (9.2%)	2 (1.4%)

Table 6
ANOVAs for outcomes for patients with mild, moderate or severe pain during hospitalization.

Outpoint and Outcome	Total Sample Mean (SD)	Mild Mean (SD)	Moderate Mean (SD)	Severe Mean (SD)	F ratio
Worst Pain (CP 35)					
Pain's Interference with function (BPI) (n = 169)	28.68 (18.89)	16.28 (16.30)	26.35 (16.62)	36.98 (17.94)	19.052***
Fatigue (MFSC) (n = 175)	47.62 (13.80)	41.83 (10.66)	46.95 (13.86)	51.11 (14.25)	6.153**
Depressive symptoms (GDS) (n = 180)	3.00 (2.22)	2.17 (2.01)	2.17 (2.49)	3.55 (1.97)	5.533**
MS equivalent in mg. administered in last 24 hours (n = 160)	7.55 (10.58)	5.44 (12.45)	5.36 (8.69)	10.49 (10.37)	4.712*
Average Pain (CP 45)					
Pain's Interference with function (BPI) (n = 154)	30.10 (18.59)	23.79 (17.50)	34.95 (15.25)	43.00 (16.81)	16.865***
Fatigue (MFSC) (n = 159)	48.13 (14.04)	46.04 (13.66)	49.86 (12.47)	52.29 (15.78)	2.79
Depressive symptoms (GDS) (n = 164)	3.02 (2.18)	2.54 (2.08)	3.12 (1.92)	4.27 (2.21)	8.671***
MS equivalent in mg. administered in last 24 hours (n = 146)	7.75 (10.19)	6.07 (9.21)	9.25 (11.34)	12.70 (9.75)	3.306*

* $p < .05$,
** $p < .01$,
*** $p < .001$

Table 7
ANOVAs for outcomes for patients with mild, moderate or severe pain 3-5 days after discharge.

Outpoint and Outcome	Total Sample Mean (SD)	Mild Mean (SD)	Moderate Mean (SD)	Severe Mean (SD)	F ratio
Worst Pain (CP 46)					
Pain's Interference with function (BPI) (n = 110)	16.61 (14.74)	11.45 (12.16)	22.52 (12.84)	32.15 (16.23)	17.817***
Fatigue (MFSC) (n = 110)	41.90 (9.74)	39.56 (8.84)	45.21 (11.07)	47.31 (7.48)	6.162**
Depressive symptoms (GDS) (n = 110)	3.24 (1.87)	2.17 (2.01)	2.17 (2.49)	3.55 (1.97)	7.088**
Average Pain (CP 47)					
Pain's Interference with function (BPI) (n = 94)	18.63 (14.67)	15.17 (12.39)	34.44 (13.82)	14 (19.80)	15.938***
Fatigue (MFSC) (n = 97)	42.68 (9.92)	42.18 (9.92)	43.41 (10.11)	45.70 (10.88)	2.261
Depressive symptoms (GDS) (n = 97)	3.40 (1.88)	3.41 (1.94)	3.55 (2.16)	3.20 (1.03)	0.206

**
 $p < .01$.

 $p < .001$.