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Pain Incidence, Treatment, and Associated Symptoms in Hospitalized Persons with Dementia

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Abstract

Objectives: The purpose of this study was to describe the incidence of pain, the pharmacologic management of pain, and the association of pain with physical function, delirium, and behavioral and psychological symptoms of dementia (BPSD) in hospitalized persons with dementia.

Design: This was a descriptive study.

Data Sources: Baseline data from 299 hospitalized persons with dementia enrolled in the Family-centered Function-focused Care (Fam-FFC) cluster randomized trial.

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The authors declare no conflicts of interest.

Methods: Cross-sectional analyses of pain using the Pain Assessment in Advanced Dementia (PAINAD) scale and the use of medication for pain management were conducted. Linear regression analyses were also performed to test relationships between pain and:1) physical function (Barthel Index), 2) delirium severity (Confusion Assessment Method Severity Short Form) and 3) BPSD severity (Neuropsychiatric Inventory- Questionnaire).

Results: The majority of the sample was female (61.9%), non-Hispanic (98%), and Black (53.2%), with a mean age of 81.58 (SD=8.54). Of the 299 patients, 166 (56%) received pain medication. Of the 108 individuals who demonstrated pain, 40% (n=43) did not receive pain medication. When controlling for age, gender, cognition, and comorbidities, pain was significantly associated with function, delirium severity, and BPSD severity.

Conclusions/Clinical Implications: The findings suggest undertreatment of pain in persons with dementia admitted to the hospital. The results provide some evidence that pain should be considered upon admission to optimize function, decrease delirium, and prevent or decrease BPSD.

Keywords

pain; hospitalization; dementia; function; delirium; behavioral symptoms

Persons with dementia are two- to three times as likely to be hospitalized as persons without dementia and comprise one-fourth of hospitalized older adults (Alzheimer's Association, 2019; Phelan et al., 2012). The presence of dementia, in combination with baseline vulnerabilities, which include advanced age, gender, co-morbidity, and severity of cognitive impairment, increases the risk for protracted delirium (Fick et al., 2013; Hessler et al., 2018; Inouye et al., 1993). Individuals with dementia are also more likely to experience functional decline that begins prior to hospitalization at the onset of the acute illness or injury (Boltz, Chippendale, Lee, et al., 2018) and persists in the post-acute setting (Zekry et al., 2008). The consequences of clinically significant functional decline and delirium in this population result in increased risk for hospital readmission, emergency department use, morbidity, earlier mortality, and long-term care placement (Daiello et al., 2014; Fong et al., 2009; Kiely et al., 2007; Sampson et al., 2009).

Behavioral and psychological symptoms of dementia (BPSD) are also common during hospitalization, with a report of three-quarters of individuals with dementia affected (Sampson et al., 2014), increasing their risk of cognitive decline and mortality (Howard, Ballard, O'Brien, & Burns, 2001). The occurrence of BPSD (agitation, apathy, repetitive questioning, psychosis, aggression, sleep problems, wandering, delusions, hallucinations, agitation, mood disturbances, anxiety, apathy, disinhibition, irritability, aberrant motor behaviors) is attributed to the unfamiliar, complex environment of the hospital and lack of meaningful cognitive and physical stimulation. BPSD are associated with higher risk for adverse events, inappropriate prescriptions of antipsychotic medications, and extended hospital stays (Corbett, Burns, & Ballard, 2014). Pain detection and management, as well as other unmet needs, are described as probable factors contributing to BPSD (Kales et al., 2015).

Persons with dementia often have multiple comorbidities frequently precipitating chronic pain as one of their most significant symptoms (Lichtner et al., 2016). Community-based studies report an estimated 50 percent of persons with dementia live with pain (Corbett et al., 2012; van Kooten et al., 2016). During hospitalization, the etiology of pain may also be acute, due to emergent conditions such as urinary retention, constipation, cardiac ischemia, deep vein thrombosis, or acute infection (Kovach et al., 2006), as well as pressure ulcers, immobility, undetected fractures, poor dentition, and uncomfortable positioning (Davis & Srivastava, 2003).

Nurses typically rely on patients' self-report of pain. Thus, pain in persons with dementia is frequently undetected due to the person's difficulty communicating (McAuliffe et al. 2012; van de Rijt et al., 2018). Other barriers to adequate pain assessment included inconsistent methods of assessing pain, and assessments conducted at different times within different contexts by numerous staff, resulting in fragmented assessments and an undermining of nurses' ability to assess the effectiveness of treatment (Lichtner et al., 2016). Additionally, healthcare professionals remain reluctant to prescribe analgesia for older patients in general, and for patients with cognitive impairment in particular (Morrison & Sui, 2000; Scherder et al., 2005), attributed at least in part the lack of rigorous guidelines for pain management in this population (Corbett et al., 2012). In hospitalized older adults, pain, whether acute or chronic, contributes to sleep disturbances, inappropriate prescribing of antipsychotic medication, impaired ambulation, cognitive decrements, and depressed mood, increasing the risk for medical complications, readmissions, and higher costs (AGS, 2004; Callahan et al., 2012; Pryor & Clarke 2017).

Although moderate to severe pain has been reported in one of five older adults admitted to hospital medical services (Deng et al., 2018), pain in hospitalized persons with dementia within the context of other symptoms has received little attention. One UK study examined pain at rest and found a relationship between pain and incident delirium (Feast et al., 2018). We know of only one study that examined the incidence of pain and its relationship with behavioral and psychological symptoms of dementia (BPSD) during hospitalization. That study, which was also conducted in the UK, reported that upon admission, 9.6% of hospitalized persons with dementia had pain at rest (a score ≥ 2 on the PAINAD scale) and found pain was associated with BPSD (Sampson et al., 2015).

There is growing awareness of the positive impact of mobility in preventing and alleviating functional decline, delirium, and neuropsychiatric symptoms (NPS). Function-focused care, an approach that emphasizes physical activity and engagement in self-care (Resnick & Boltz, 2016), shows promise of improving functional, cognitive, and behavioral outcomes in persons with dementia (Boltz, Chippendale, Resnick, et al., 2015; Resnick, Galik, Wells, et al., 2015). Given that pain has a significant influence upon a person's level of activity as well as cognition and behavior (Han & Pae, 2015), it is logical to target pain as a syndrome to be assessed for and managed to improve behavioral outcomes and prevent functional and cognitive decline during hospitalization.

Gaining a better understating of the relationships between pain, function, delirium and BPSD in hospitalized patients with dementia will help establish pain as a critical symptom

to target on admission and throughout the hospital stay and post-acute period. The purpose of this study was to describe the incidence of pain in hospitalized persons with dementia, the pharmacologic management of pain, and the association of pain with physical function, delirium, and BPSD. Specifically, we hypothesized, considering age, gender, comorbidities, and cognition (intrinsic patient factors known to influence clinical outcomes), that pain would be associated with function, delirium. and BPSD in persons with dementia upon admission to the hospital.

METHODS

Design and Sample

This descriptive, **cross-sectional** study used baseline data from an ongoing cluster randomized clinical trial (ClinicalTrials.gov identifier: NCT03046121). The investigators in that trial are testing the efficacy of Fam-FFC (Family-centered Function-focused Care), a nurse-family caregiver (FCG) partnership model that aims to improve: 1) the physical and cognitive recovery in hospitalized persons living with Alzheimer's disease and related dementias (ADRD) during hospitalization and the 60-day post-acute period; and 2) FCG preparedness and experiences. The protocol has received institutional review board approval and has been published (Boltz et al., 2018).

Baseline data for 299 patients from six medical units in three hospitals (two units per hospital) were included, including one large academic medical center, a medium-sized teaching hospital, and a small community hospital, located in Pennsylvania. Family caregivers were also enrolled as study partners in the intervention. Patients were eligible to participate if they were age ≥ 65 years, spoke English or Spanish, lived in the community prior to admission to the hospital, screened positive for dementia on the Montreal Cognitive Assessment (MoCA ≤ 25) (Nasreddine et al., 2005) and AD8 ≥ 2 (Galvin, Roe, Xiong, & Morris, 2006), had a diagnosis of very mild to moderate stage dementia as confirmed by a score of 0.5 to 2.0 on the Clinical Dementia Rating Scale (CDR) (Morris, 1997), and had a family caregiver (FCG) as the designated study partner for the duration of the study. Patients were excluded from the study if they had mild cognitive impairment (CDR = 0.5 without functional or ADL impairments), severe dementia (CDR =3), any significant neurological condition associated with cognitive impairment other than dementia (e.g., brain tumor), a major acute psychiatric disorder, had no FCG to participate, were enrolled in a hospice, and were admitted from a nursing home.

Measures

Sample characteristics included age, gender, co-morbidity, cognition, and diagnoses. The use of medication prescribed for pain was also extracted from the medical record. Comorbid conditions were classified with the *Charlson Comorbidity Index,* a weighted index that takes into account both the number and seriousness of different co-morbid diseases. The Charlson Comorbidity Index is a valid and reliable measure of disease burden (Van Doorn et al., 2001). Cognition was evaluated with the *Montreal Cognitive Assessment (*MoCA), a cognitive screening tool that measures executive function, orientation, memory, abstract thinking, and attention and demonstrates excellent sensitivity and specificity, differentiating

between mild cognitive impairment, no dementia, and dementia (Nasreddine at el., 2005). The MoCA has been validated in culturally diverse populations and differing educational levels (Berstein et al., 2011).

Pain was measured using the *Pain Assessment in Advanced Dementia (PAINAD*). The PAINAD is a five-item observational tool that evaluates behaviors commonly found in persons experiencing pain: breathing independent of vocalization, negative vocalization, facial expression, body language, and consolability. Scores range from 0 to 2 for each behavior. A score of 1–3 indicates mild pain, 4–6 is moderate pain, and 7–10 is severe pain. The PAINAD has demonstrated high interrater reliability and validity (Warden et al., 2003). The Cronbach alpha for the PAINAD was .78 in this study.

Data about physical function was derived from the *Barthel Index*, a ten item measure of activities of daily living (ADL; Mahoney & Barthel, 1965). There is sufficient evidence for the reliability and validity of the Barthel Index when used with older adults, individuals with progressive neurological conditions, (Resnick & Daly, 1997), and when proxy respondents were utilized to report the functional abilities of persons with dementia (Ranhoff, 1998). Items are evaluated based upon the degree of assistance required. Scores range from 0 (total dependence in all ADLs) to 100 (total independence). The Cronbach alpha for the Barthel Index in this study was .79.

Delirium severity was measured with an additive score for the four items of the *Confusion Assessment Method Severity* fluctuating course is scored as no (0) or yes (1). Inattention and disorganized thinking are each scored as “absent” (0 points), present in mild form (1 point), or present in severe form (2 points). (CAM-S) Short Form (Inouye, 2014). Acute onset and The fourth item, altered level of consciousness, is scored as alert or normal (0 points), vigilant or lethargic (1 point), and stupor or coma (2 points). Scores range from 0–7, with a higher score indicating greater severity of delirium. The CAM-S Short Form has demonstrated strong psychometric properties and associations with important clinical outcomes, including length of stay, functional decline, nursing home placement, and death (Inouye et al., 2014). The Cronbach alpha for the CAM -S Short Form was .75 in this study.

BPSD was assessed using the *Neuropsychiatric Inventory- Questionnaire* (NPI-Q) a 12-item, informant-based assessment of delusions, hallucinations, agitation/aggression, dysphoria/ depression, anxiety, euphoria/elation, apathy/indifference, disinhibition, irritability/lability, aberrant motor behaviors, night-time behavioral disturbances, and appetite/eating disturbances (Kaufer et al., 2001). BPSD is assessed in terms of severity on a three-point scale (1-mild, 2-moderate, 3-severe). The total NPI-Q severity score represents the sum of individual symptom scores and ranges from 0 to 36, and can be completed in 5–10 minutes. The NPI-Q is widely used in clinical research studies to evaluate neuropsychiatric symptoms, their interaction with other symptoms, and their response to treatment in dementia patients (Ford, 2014). In addition to adequate test-retest and interrater reliability, it shows concurrent validity with other measures, including relevant items from the Hamilton Rating Scale for Depression and Behavioral Pathology in Alzheimer’s Disease Rating Scale (Behave-AD). The Cronbach alpha for the NPI-Q was .90 in this study.

Procedures

After **informed consent** and screening for eligibility, participants were assessed by trained research staff blind to treatment condition. Demographic and descriptive information was extracted from the electronic health record, including age, gender, race, ethnicity, diagnosis, co- morbidity, and medications indicated to treat pain. Observational measures of pain, delirium, ADL function, and neuropsychiatric symptoms were taken within 48 hours of admission, prior to the implementation of the Fam-FFC intervention.

Analysis

Descriptive statistics described the sample, using SPSS Version 26 (IBM Corp, Armonk, NY). The frequency of pain using the PAINAD and the use of analgesic medication was examined. Hypothesis testing was conducted using linear regression analyses and a hierarchical approach. First, bivariate analyses were conducted examining the relationships between age, gender, co-morbidities, and cognition. Then outcome measures of ADL function, delirium severity, and severity of BPSD were regressed on pain, controlling for age, gender, co-morbidities, and cognition as indicated by a p value < .05 in the bivariate analysis. Collinearity Statistics, *tolerance* and the variance inflation factor (*VIF*), were also examined to determine if the data met the assumption of collinearity. A tolerance of less than 0.20 or 0.10 and/or a VIF of 5 or 10 and above was considered to be indicative of a multicollinearity problem (Draper & Smith, 2003). Multicollinearity was not a concern (Function, Tolerance = .96, VIF = 1.04; Delirium, Tolerance = .96, VIF = 1.0; and BPSD Tolerance = .96, VIF = 1.0).

RESULTS

As shown in Table 1, the majority of the sample was female (61.9%), non-Hispanic (98%), and Black (53.2%), with a mean age of 81.58 (SD=8.54). The overall mean score for the MoCA was 10.49 (SD = 6.96), indicating significant cognitive impairment, and the mean Charlson co-morbidity score was 3.84 (SD=2.37). The sample demonstrated moderate functional impairment with a Barthel Index score of 60.24 (SD=28.30). The participants on average had low levels of delirium severity (mean= 1.50, SD= 1.75) and generally demonstrated low levels of severity of BPSD (mean= 9.71, SD= 5.99). The admitting diagnosis included acute pain (abdominal pain, chest pain, and other pain) for 29 (10%) of the sample; the remaining diagnoses included altered mental status (n=32, 11%), pneumonia/respiratory failure (n= 31, 10%), falls/syncope (n= 28, 9%), heart failure (n=27, 9%), respiratory failure (n= 20, 7%), urinary tract infection (n= 25,8%) other infections (n= 21,7%) metabolic conditions (n= 19, 6%), cardiac problems (n= 21, 7%) gastro-intestinal conditions (n=18, 6%) cancer (n=14, 5%), arthritis (n=8, 3%) and other (n= 6, 2%). As reported in Table 2, 36% of the sample (n=108) demonstrated pain according to the PAINAD scale, with 86 participants (28%) showing mild pain, 19 individuals (7%) showing moderate pain, and 3(1%) individuals showing severe pain.

As indicated on Table 3, of the total 299 participants, a little more than one half received some type of pain medication (n= 166, 56%). Of the 166 individuals who received analgesics, 65 were reported to have pain based upon the PAINAD. The most frequently

prescribed analgesic was acetaminophen (n=91, 64%) and was the sole analgesic in 99 (60%) of the participants showing pain. The next most frequently prescribed analgesic was oxycodone, followed by morphine, topical analgesics (ointments and patches), tramadol, hydromorphone, fentanyl, methadone, and non-steroidal anti-inflammatory drugs (NSAIDs). Most of the medications were prescribed on a prn (as needed) basis as opposed to standing orders. Forty-three of the 108 participants who demonstrated pain (40%) were not prescribed analgesic medication.

Patient age (r = −.125, p = .031), gender (r =.131, p = .037), cognitive status (r =.328, p <.0001), and pain (r =−.244, p <.0001), but not co-morbidity (r = −.063, p =.283) were correlated with admission ADL function. Table 3 shows that as hypothesized, pain was significantly associated with ADL function, when controlling for age, gender, and cognition, and accounted for 16% of the variance (β = −.18, t = −3.2, p =.001).

Patient cognitive status (r =. −.441, p <.0001) and pain (r = −.335 p <. 0001), but not age (r = .052, p = .367), gender (r =−.015, p = .396), co-morbidity (r = −.061, p =.297) were correlated with delirium severity. Table 3 shows that, controlling for cognitive status, pain was significantly associated with delirium severity and accounted for 26% of the variance (β = .23, t = 5.0, p <.0001).

Patient age (r =. −.122, p =.042), cognitive status (r =. −.162, p = .007) and pain (r =.162 p =. 007), but not gender (r = .14, p = .822) and co-morbidity (r =−.099, p = .101), were correlated with delirium severity. Table 3 shows that pain was significantly associated with BPSD severity and accounted for 7% of the variance (β = .14, t = 2.3, p =.023).

DISCUSSION

The incidence of pain in this sample of hospitalized persons with dementia (36% any pain and 16% with a PAINAD score ≥ 2) was lower in this study than the 42.4% who had pain (PAINAD score ≥ 2) on baseline assessment reported by Sampson et al. (2015). Our study, unlike the Sampson et al. (2015) study, excluded patients admitted from nursing homes who typically are more functionally dependent and thus more likely to have musculoskeletal pain than those not admitted from nursing homes (Resnick & Galik, 2015). Some differences may also be due to differences in the timing of the observations and level of patient activity. Our study evaluated pain during a brief observation (5 minutes) that included some type of physical activity. The activity varied from patient to patient and was limited in intensity by the patient's acuity upon admission. Thus the prevalence of pain may have been underestimated in this sample.

This study supported the hypothesized relationships between pain and three important clinical indices -ADL function, delirium, and BPSD in newly admitted hospitalized older adults with dementia. Although only a small percentage of the variance in function, delirium severity and BPSD was explained these associations are important as pain is a modifiable factor and can be treated to help optimize function, decrease intensity of delirium, and decrease BPSD. Prior research has also supported the association between pain and BPSD in nursing home resident (Horgas, 2013; Tosato et al., 2012) and in the hospitalized patients

with dementia setting (Sampson et al., 2015). Likewise, the association between delirium and pain was previously supported by prior research with hospitalized older adults and subacute nursing home residents (Feast et al., 2016; Kolanowski et al., 2014). In hospitalized older patients it was noted that the odds of being delirious were 3.26 times higher in hospitalized individuals with dementia who experienced pain at rest (Feast et al., 2018). Among nursing home residents it was noted that on days in which residents experienced greater than their average level of pain they also experienced more delirium symptoms and lower physical function (Kolanowski et al., 2014). Multiple studies have shown an association between pain and function in community -residing older adults (Bernfort et al., 2015; Eggermont et al., 2014) again supporting the critically important need to address and manage pain among older individuals.

Of the 108 individuals who demonstrated pain, 40% (n=43) did not receive analgesic medication. This is higher than the 12% reported by Sampson et al. (2015) in UK hospitals as well as the rate of 17% in nursing homes (Fain et al., 2017). This rate of potentially insufficient pain management is similar to the rate reported by Resnick and colleagues (2019) in assisted living. Patient satisfaction with pain management is one of the quality indicators for acute care included in the National Database of Nursing Quality Indicators™ (NDNQI®) thus it was surprising to note the high rate of individuals in which pain was not addressed. It is possible that at the time of admission the staff were still evaluating the individual and gathering data about pain management in the past. In the hospital settings, pain management may not have been consistently prioritized, perhaps due to an emphasis on treating the acute admitting problem. Clinician knowledge of pain assessment and management in persons with dementia, and the adaptation of protocols to individuals with cognitive impairment may also have been a factor. In 2018, new and revised pain assessment and management standards were issued to all Joint Commission-accredited hospitals, requiring them to identify pain assessment and pain management, including safe opioid prescribing, as an organizational priority (LD.04.03.13), and assess and manage the patient's pain and minimize the risks associated with treatment (PC.01.02.07). These requirements do not address the specialized needs of persons with dementia however, including explicit guidelines for assessment and management, adapted to the clinical presentation of pain in persons with cognitive impairment.

The rate of opioid use (22%) was less than the 33% reported in the Sampson et al. (2015) study. Based on data collected in both studies it is not possible to evaluate whether this utilization reflects appropriate pain management or over-utilization of opiates. An examination of prescribing practices, in tandem with non-pharmacological management; pain responses using consistent, standardized measures; and side-effect profiles is warranted in future research.

There were 166 individuals who received analgesics, yet only 65 were reported to have pain based upon objective assessment. It is possible that the 101 individuals who did not demonstrate signs of pain were being appropriately managed. Conversely, it is also possible that the medication for pain prescribed was not necessary, or could have been decreased in dose. This study did not evaluate the use of non-pharmacological interventions which may have been used concurrently with analgesics. On-going research is needed to evaluate the

efficacy and overall patient response to various medications, opiates, and non-opiates as well as non-pharmacologic interventions for pain, such as hot/cold applications, positioning, and complementary therapies.

Nursing Implications

The findings of this study underscore the importance of using a valid and reliable assessment tool, such as the PAINAD, to promote detection and management of pain in persons with dementia. The association of pain with three symptoms- physical function, delirium, and BPSD suggest that pain should be evaluated as a contributing factor to these clinical outcomes, and should be considered when developing and evaluating treatment plans to optimize physical, cognitive, and behavioral function. In turn, physical function, delirium, and BPSD should be considered when evaluating the effectiveness of pain management interventions.

Limitations

This study was limited by its relatively small sample in three hospitals in the same state, so the findings cannot be generalized to all hospital settings. This was a cross-sectional study and we did not measure changes in symptoms or medication use over time. The study also did not examine other factors that may influence pain, function, delirium, and BPSD, such as the physical and social environment, staff knowledge and skill, other medical treatments besides the use of analgesic medication, the quality of care interactions, social supports, and perhaps other unknown patient, family, and staff characteristics, including cultural and other attitudes related to pain and other symptoms.

Conclusion

Despite limitations, this study provided important information about the occurrence of pain, pain management, and the association of pain with symptoms commonly experienced by hospitalized persons with dementia. Results showed that, despite indications of pain, 40% of hospitalized older adults with dementia, did not receive any pain medication. This finding demonstrates the need to examine and address the factors associated with undertreatment of pain in this vulnerable population, in order to ensure effective and humane nursing care throughout the hospital stay. Pain measured by PAINAD was significantly associated with function, delirium severity, and BPSD, though it accounted for only a small amount of the variance across any of these outcomes. The results provide some evidence that pain should be considered upon admission to optimize function, decrease delirium, and prevent or decrease BPSD. Longitudinal research is needed to examine the effects of both pharmacological and non-pharmacological interventions, provided upon admission, and continuing throughout the hospitalization, upon pain as well as functional, cognitive, and behavioral outcomes.

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Table 1

Description of the Sample

Variable			
	n (%)		
Female	185 (61.9)		
Black	159 (53.2)		
Non-Hispanic	293 (98.0)		
	Minimum	**Maximum**	**Mean (SD)**
PAINAD	0	10.00	.77 (1.48)
Age	65.00	105.00	81.58 (8.54)
Cognition (MoCA)	0	25.00	10.49 (6.96)
Co-morbidity	1.00	12.00	3.89 (2.34)
Delirium Severity (CAM-S)	0	7.00	1.50 (1.75)
ADL Function	0	100.00	60.24 (28.30)
BPSD	0	31.00	8.71 (5.99)

Table 2

Frequency of Pain Severity in the Sample (N=299)

Pain Severity	n (%)
0	191 (64)
1	61 (20)
2	18 (6)
3	7 (2)
4	8 (3)
5	8 (3)
6	3 (1)
7	2 (.7)
10	1 (.3)

Table 3

Medication for Pain Use in the Total Sample (N=299)

Any Type of Medication Use	n (%)
Yes	166 (56%)
No	133 (44%)
Medication Use Among the Individuals Receiving Pain Medication (217 medications in 166 individuals)	
Medications	n (%) of medications prescribed
Acetaminophen (prn)	139 (64)
Oxycodone (prn)	21 (10)
Morphine (4 standing, 14 prn)	18 (8)
Topical analgesics (standing)	15 (7)
Tramadol (prn)	13 (6)
Hydromorphone (prn)	4 (2)
Fentanyl (standing)	3 (1)
Methadone (prn)	2 (1)
NSAIDs (standing)	2 (1)
Medication Use Among the Individuals who Demonstrated Pain (95 medications in 65 individuals)	
Medications	n (%) of medications prescribed
Acetaminophen (prn)	52 (55)
Oxycodone (prn)	11 (12)
Morphine (2 standing, 6 prn)	8 (8.4)
Topical analgesics (standing)	8 (8.4)
Tramadol (prn)	6 (6.2)
Hydromorphone (prn)	4 (4)
Fentanyl (standing)	3 (3)
Methadone (prn)	2 (2)
NSAIDs (standing)	1 (1)

Table 4

Regression Models for Association of Pain with Function, Delirium Severity, and BPSD

Model 1: Function				
Measure	**Adjusted R2**	**F change (p)**	***β***	***t* (*p*)**
Age	0.13	4.8 (.029)	−.071	−1.2 (.217)
Gender	0.27	3.2 (.077)	.095	1.7 (.082)
Cognition	0.13	33.5 (.000)	.286	5.1 (.000)
Pain	0.16	10.5 (.001)	−.178	−.3.2 (.001)
Model 2: Delirium Severity				
Measure	**Adjusted R2**	**F change (p)**	***β***	***t* (*p*)**
Cognition	0.19	70.6 (.000)	−.40	−7.47 (.000)
Pain	0.26	25.3 (.000)	.26	5.0 (.000)
Model 3: Behavioral and Psychological Symptoms of Distress (BPSD)				
Measure	**Adjusted R2**	**F change (p)**	***β***	***t* (*p*)**
Age	0.02	5.4 (.021)	−.17	−2.61 (.009)
Cognition	0.05	11.2 (.011)	−.17	−2.8 (.005)
Pain	0.07	5.3 (.023)	.14	2.3 (.023)