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Assessing advanced cancer pain in older adults with dementia at the end-of-life

Todd Monroe, PhD,

JAHF & Atlantic Philanthropies Claire, M. Fagin Fellow, Vanderbilt University School of Nursing, Nashville, Tennessee, USA

Vanderbilt University Institute of Imaging Science, Nashville, Tennessee, USA

Michael Carter, DNSc, DNP,

University Distinguished Professor, The University of Tennessee Health Science Center, College of Nursing, Memphis, Tennessee, USA

Karen Feldt, PhD [Associate Professor],

Seattle University, College of Nursing, Washington, USA

Betsey Tolley, PhD [Professor], and

Professor, The University of Tennessee Health Science Center, College of Nursing, Memphis, Tennessee, USA

Ronald L. Cowan, MD, PhD [Associate Professor]

Associate Professor, Vanderbilt School of Medicine, Director Vanderbilt University Psychiatric, Neuroimaging Program, Nashville, Tennessee, USA

Abstract

Aim—To assess advanced cancer pain in older adults with dementia at the end-of-life.

Background—Self-report is the gold standard for pain assessment; however, people with Alzheimer's disease may lose the ability to report pain. Biochemical and neuropathological changes occur in Alzheimer's disease that impairs the affective, sensory, and motor pain processing regions of the brain. Because people with severe Alzheimer's disease may lose the ability to report their sensory and emotional response to pain verbally, external motor displays of pain, such as grimacing, have been suggested for use in people with Alzheimer's Disease.

Design—Between groups cross sectional study.

Method—Retrospective chart audits of people with Alzheimer's disease in nine nursing homes in the US in 2009. Participants were nursing home residents ($n = 48$) with mild to very severe dementia, pain and cognitive measures were collected during the final 3 months of life. The

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Correspondence to T. Monroe: todd.b.monroe@vanderbilt.edu.

Conflicts of interest

No conflict of interest has been declared by the authors.

Author contributions

TM, MC, KF, and BT were responsible for the study conception and design. TM and MC performed the data collection. TM and BT performed the data analysis. TM was responsible for the drafting of the manuscript. TM, MC, KF, BT, and RC made critical revisions to the paper for important intellectual content. BT provided statistical expertise. MC, KF, BT, and RC supervised the study.

primary outcome variable was the Discomfort Behaviour Scale score (a measure of observed pain behaviour) and the main predictor variable was the Cognitive Performance Scale score (a measure of Alzheimer's disease severity). Medication administration (opioid, non-narcotic, and psychotropic medications) recorded over the final 2 weeks of life was collected as a covariate of interest.

Results—Alzheimer's disease severity was negatively associated with pain behaviours. *Post hoc* procedures showed that this difference was due to the difference in pain behaviours between individuals with moderate and very severe Alzheimer's disease. Total amount of opioid analgesic, total number of doses of non-narcotic medications, and psychotropic medications administered over the last 2 weeks of life were not statistically significantly correlated with pain behaviour. An inverse correlation was found between cognitive ability (Cognitive Performance Scale score) and total amount of opioid medication indicating that individuals with severe Alzheimer's disease received less opioid.

Conclusion—Because people with worsening Alzheimer's disease have fewer pain behaviours, assessing pain using behavioural indicators can be a challenge. Improving methods to assess for pain in people with Alzheimer's disease is of critical public health importance. Moreover, future studies are urgently needed to further examine the sensory, emotional, and behavioural responses to pain in people with Alzheimer's disease.

Keywords

Alzheimer's disease; cancer pain; Cognitive Performance Scale (CPS); Discomfort Behavioural Scale (DBS); pain; pain behaviours

Introduction

The number of individuals with Alzheimer's disease (AD) worldwide is projected to increase from 36 million in 2010 to over 115 million in 2050 with China, India, and countries in South Asia and neighbouring Pacific countries being affected the most (Alzheimer's Disease International, 2010). Current estimates are that at least one half of nursing home residents have AD (Magaziner *et al.* 2000). Because AD often occurs along with painful comorbidities such as osteoarthritis (Tsai, 2008) or cancer (Monroe & Carter 2010), healthcare providers' understanding of how pain is experienced in persons with AD is essential to quality care. Although the accepted standard of pain assessment is self-report (McCaffery 1968, Herr & Garand 2001), people with AD may lose the ability to verbalize their pain (Herr *et al.* 2006). Unmanaged pain is known to be associated with depression and functional limitations, which contribute to suffering (Blixen & Kippes 2007).

Background

Because the ability to verbally report the sensory and affective response to pain may be lost in people with severe AD, motor (behavioural) responses become the standard pain assessment method. Pain behaviours provide clinicians with a potential objective opportunity to evaluate discomfort (American Geriatrics Society Panel on Persistent Pain in Older Persons, 2002). Approximately 75% of adults with dementia will end their lives in the

nursing home (Alzheimer's Association, 2011). The prevalence of pain in nursing home residents has been estimated to range from 50% (Ferrell *et al.* 1995) to over 80% (Roy & Thomas 1986). Cancer is of particular concern because older adults with cancer living in the nursing home may experience severe pain (Ferrell *et al.* 1995) leading to more comorbid medical problems (Thome & Hallberg 2004). A seminal study ($n = 13,625$) of nursing home residents with cancer found that 26% with daily pain – many with cognitive impairment – received no analgesic (Bernabei *et al.* 1998). Unfortunately, the consequences of untreated cancer pain can be devastating. More than 50% of hospitalized patients with cancer described their pain as 'distressing, horrible, or excruciating' and reported that pain interfered with movement and sleep (Yates *et al.* 1995). Among seriously ill patients—including those with colon and lung cancer – 40% experienced severe pain in the last 3 days of life (Lynn *et al.* 1997). Ultimately, clinicians rely on behavioural (motor) indicators of pain in the absence of verbal reports of pain sensation, yet findings suggest that both people with AD (Delacourte *et al.* 1999) and people with cancer (Yates *et al.* 1995) may each have impaired motor function. Thus, behavioural assessment of pain in people with AD who have cancer is a challenge. Without obvious external signs of pain, clinicians may decide not to administer analgesics (Elliott & Horgas, 2009).

Nursing home residents in several countries are required to have a health status assessment using the minimum data set (MDS) upon admission, quarterly, and with a statistically significant change in the resident's health status (US Department of Health Human Services, 2000). The MDS includes over 250 items on demographic and diagnostic variables and clinical, functional, psychosocial, and cognitive assessments (Morris *et al.* 1994). A Registered Nurse completes the MDS using medical records, direct observations, input from co-workers, and family interactions over 7 days (Stevenson *et al.* 2006). The MDS has strong inter-rater item reliability (>0.75) (Mor *et al.* 2003) and the MDS is reliable for data collection in nursing home residents (Hawes *et al.* 1995). Because the MDS is standardized across nursing homes in many countries, instruments have been developed using certain items to measure cognitive ability (Morris *et al.* 1994) and pain (Stevenson *et al.* 2006).

Findings related to the ability of individuals with AD to report pain have been mixed. Investigators have shown that people with AD report less pain intensity and demonstrate lower affective responses to pain (Scherder *et al.* 1999), whereas others have found that individuals with AD report more pain intensity and have greater affective responses to pain (Cole *et al.* 2006). Neuropathological and electroencephalogram (EEG) studies of pain in people with AD show that the brain regions contributing to the affective pain response are affected earlier in the disease process than the sensory pain response areas (Rub *et al.* 2002). Moreover, biochemical pathology studies show that the primary motor areas in the brain are also affected later in the course of AD (Delacourte *et al.* 1999), suggesting that the neuropathological changes spare the sensory pain and motor pathways until later in the course of AD. Together, these findings suggest that individuals with AD have pain; however, as AD progresses and the ability to detect, interpret, and verbally or behaviourally communicate may be lost, people with AD could feel pain or distress from pain, but may be unable to behaviourally express it. The current study extends findings from a larger study comparing hospice status in nursing home residents with dementia and advanced cancer by examining how AD severity may affect the outward display of pain behaviours. Specifically,

findings using the Discomfort Behaviour Scale (Stevenson *et al.* 2006) and the Cognitive Performance Scale (Morris *et al.* 1994) are reported. Because brain regions involved with the affective processing of pain may be earlier and progressively more affected by AD than the sensory and motor regions, the research hypothesis for this study was that pain behaviours recorded in the medical record would decrease as AD worsened.

The study

Aim

The aim of the study was to use medical records to assess advanced cancer pain in older adults with dementia at the end-of-life.

Design

The current study employed a retrospective between groups cross-sectional design. Chart audits of people with AD were collected in 2009. This study is a sub-analysis of a data set from a larger study on pain in nursing home residents with and without hospice services during the last 3 months of life. We previously reported that in the presence of similar cognitive abilities and opioid medication intake, African-Americans had significantly higher DBS scores indicating that different ethnicities may experience pain differently (Monroe & Carter 2010). The present study explored the effect of worsening cognitive impairment on the outward display of pain behaviours. For the purposes of this study, the term cognitive impairment or CPS score serves as a proxy for AD severity. All data were collected by the lead author [TM].

Sample

Using a regional telephone directory, the primary author developed a list of 11 nursing homes to participate in the study. The nursing homes were stratified to include for-profit (3) and not-for-profit (8) institutions, ranging in size from 68 to 180 beds located in the inner city, rural, and suburban areas in and up to 150 miles from Memphis, TN, USA. Of these, nine [for-profit (2) and not-for-profit (7)] agreed to participate, yielding a response rate of 82%. A total of 48 subject records were included in the analysis. All medical records of residents in whom a diagnosis of AD, Lewy body dementia, vascular dementia, or mixed dementia (ICD-9 codes; 331.0, 290.4, 331.82, or some combination thereof) and who died from cancer were considered for inclusion.

Primary measures

The primary outcome measure used in the current study was the Discomfort Behaviour Scale (DBS), a measure of pain based on direct observation of behaviour. The DBS was developed as an alternative tool for pain assessment when cognitive impairment prohibits self-report. The DBS, a 17-item instrument derived from assessment items on the Minimum Data Set (MDS) 2.0, addresses behaviours that may indicate pain. As the DBS assessment is derived from existing MDS data, it allows a retrospective analysis of behaviours that may have indicated pain in the weeks preceding death. Items were taken from specific MDS data believed to be behavioural indicators of discomfort and pain: repetitive verbalizations, insomnia/change in sleep, sad/worried, crying/tearfulness, repetitive physical movements,

withdrawn, reduced social interaction, wandering, verbally abusive, physically abusive, socially inappropriate, and resisting care. Composite reliability of the DBS was 0.98, with a Cronbach's alpha of 0.77 (Stevenson *et al.* 2006). The DBS is scored from 0–102. The instrument development study by Stevenson and colleagues ($n = 29,120$) included older adults who were cognitively impaired in Wisconsin, USA and reported a median score of 3, modal score of 0, and a range from 0–96 (Stevenson *et al.* 2006).

The primary predictor measure in the current study was the Cognitive Performance Scale (Morris *et al.* 1994). The CPS is a reliable and valid instrument (Paquay *et al.*, 2007) developed from five MDS items suggestive of cognitive ability. These items are comatose, short-term memory, cognitive skills for decision-making, making self understood, and eating (Morris *et al.* 1994). Investigators studied the reliability and validity of the CPS among nursing home residents in Maryland, USA ($n = 1939$) and found moderately strong correlations with the Mini Mental State Exam (MMSE) ($r = -0.65$). The researchers concluded that the CPS had moderate validity for assessing cognitive impairment among nursing home residents (Gruber-Baldini, Zimmerman, Mortimore, & Magaziner, 2000). The CPS is scored from 0 to 6, indicating 'intact' to 'very severe impairment'. CPS scores of 4, 5, and 6 are associated with MMSE scores of 7, 5, and 1, respectively, whereas CPS scores of 2 and 3 are associated with MMSE scores of 19 and 15 (Morris *et al.* 1994).

Covariate measures

All covariate pain medication administration data were collected over the final 2 weeks of life. Total opioid medications were converted to levorphanol equivalent doses. Total numbers of doses of non-narcotic and psychotropic medications were counted.

Opioid pain medications

All opioid medications administered over the last 2 weeks of life were converted to equivalent dose units using an opioid online conversion calculator standardized to levorphanol (1 mg = 1EDU) where 10 mg of codeine = 0.05 EDU; 10 mg of hydrocodone = 0.33 EDU; 10 mg of hydromorphone = 1.33 EDU; 10 mg of meperidine = 0.03 EDU; 10 mg of methadone = 2.5 EDU; 10 mg morphine = 0.33 EDU; 10 mg of oxycodone = 0.50 EDU; 10 mg of oxymorphone = 1 EDU; and 25 mcg of fentanyl = 3 EDU (Arkansas Medicaid, 2007).

Non-narcotic medications

The total numbers of doses of non-narcotic analgesics (i.e. acetaminophen, acetylsalicylic acid, ibuprofen, and naproxen sodium) that were administered over the last 2 weeks of life were counted and recorded.

Psychotropic medications

For this study psychotropic medications were defined as any, sedative/hypnotic, anxiolytic, antipsychotic, antidepressant, antihistamine, etc., medication that could alter levels of consciousness. The total number of doses of psychotropic medications that were administered over the last 2 weeks of life were counted and recorded.

Cancer type

The cancer diagnoses (Table 1) were established from the Centers for Disease Control (CDC) top 10 cancers of the overall population for all races and genders in 2004 (US Cancer Statistics Working Group, 2008). These common cancers were chosen to provide a feasible framework for data collection while providing a homogeneous sample.

End-of-life

The primary MDS related variables (i.e. cognitive status [CPS] scores and pain status [DBS] scores) were collected during the end-of-life period. We defined the end-of-life period as the last 90 days of life based on the date of the last MDS assessment prior to death. Previous work by Mitchell *et al.* (2004) using MDS data similarly defined the end-of-life period as the last 120 days of life.

Inclusion/exclusion criteria

Inclusion criteria

The lead author [TM] located potential records by using Vista KEANE MDS software in each nursing home (Keane Care Inc., Redmond, WA). Vista KEANE is an electronic, MDS documentation system. The Vista KEANE system allows multiple levels of searches including access to full MDS assessments with medical diagnoses labelled by ICD-9 codes (a diagnostic medical coding system). Records were provisionally included if the resident had dementia, died in the nursing home, and if the cause of death recorded in the medical record or on the death certificate was cancer. Due to the difficulty in locating nursing home residents with dementia who died from terminal cancer, the years 2003–2009 were included in the analyses.

Exclusion criteria

Because we were interested in assessing pain in those with ‘likely dementia’, exclusion criteria were a CPS score of 0 (cognitively intact) or 1 (borderline intact), inability to determine the cause of death, or incomplete medical records. Seventy-six residents with a diagnosis of both AD and cancer between 2003–2009 were located. Twenty-one records were excluded because of the inability to definitively determine the cause of death as cancer or the location of death as the nursing home. Seven patients were then excluded because they had CPS scores of 0 or 1, leaving a final sample of 48 consisting of 43 people with AD (90%), 4 people with vascular dementia (8%), and 1 person with Lewy Body dementia (2%).

Data collection procedures

First, the CDC list of 10 malignant cancer codes was used to search ‘client by diagnosis’. ‘Client by diagnosis’ is a default option in the Vista KEANE software used to locate nursing home residents with specific traits. This electronic list was then cross-referenced to locate individuals with a positive diagnosis of AD, Lewy body AD, vascular AD, or mixed AD (ICD-9 codes; 331.0, 290.4, 331.82, or some combination). Second, each medical record was physically retrieved to verify a positive diagnosis of AD, Lewy body AD, vascular AD, or mixed AD (ICD-9 codes; 331.0, 290.4, 331.82, or some combination thereof). Third,

DBS and CPS instrument scores were calculated from the same MDS assessment in the last 90 days of life. Five CPS groups were included in the current analysis: mild (CPS = 2), moderate (CPS = 3), moderately severe (CPS = 4), severe (CPS = 5), and very severe (CPS = 6) cognitive impairment.

Ethical considerations

The study received Institutional Review Board approval from The University of Tennessee Health Science Center. Participating nursing homes provided a letter of agreement from the chief nursing home administrator.

Data analyses

The data were analysed using SPSS 16.0 (IBM Corporation, Somers, NY) and were tested for normality using standard plotting methods before conducting the analyses. The data violated the assumptions of normality and non-parametric procedures were therefore used for analyses. Descriptive statistics (Table 1) were used to characterize the sample. Differences in observable pain behaviour (DBS score) among the AD severity levels (CPS score) were analysed using the Kruskal–Wallis test with cognitive status (CPS score of 2, 3, 4, 5, or 6) as the between groups factor and pain behaviour (DBS score) as the outcome variable. *Post hoc* analyses were performed using the Mann–Whitney test with Bonferroni correction to determine group differences. Possible other variables associated with observable pain behaviour (referred to as covariates—total opioid, number of doses of nonnarcotic, and number of doses of psychotropic medications)—were analysed with bivariate Spearman's correlations (r_s).

Results

Table 1 shows the characteristics of the sample in this study. The participants had a mean age of 86 years (SD 8 years) and a mean CPS score of 4.1 (SD 1.4). The research hypothesis that DBS scores (numbers of pain behaviours recorded in the chart) would decrease as AD worsens was supported. DBS scores increased from a CPS score of 2 to 3 and then decreased monotonically as AD worsened from (CPS = 3) to (CPS = 6) (Table 2). A statistically significant difference in pain behaviour among the levels of AD severity was found (Kruskal–Wallis Test $\chi^2 = 9.34$, $P = 0.05$). *Post hoc* procedures showed that this overall difference was due to the difference in pain behaviours between individuals with moderate (CPS = 3) and very severe (CPS = 6) AD ($P = 0.005$). No statistically significant associations of total dose of opioid ($r_s = -0.09$, $P = 0.273$) or numbers of doses of non-narcotic ($r_s = 0.14$, $P = 0.169$) and psychotropic ($\rho = 0.11$, $P = 0.223$) medications with pain behaviour were observed (Table 3). A statistically significant negative correlation ($\rho = -0.44$, $P = 0.001$) was found between cognitive ability (CPS score) and total amount of opioid medication (Table 3), indicating that individuals with severe AD received less opioid.

Discussion

Study limitations

Several factors limit definitive conclusions about the role of worsening AD severity in reducing observable pain behaviours. Some of the nursing home residents were contemporaries and therefore not truly independent observations; however, because resident records were selected over many years these observations were more likely to behave independently in the current analyses. The sample size was modest; however, we tightly controlled inclusion criteria to reduce subject variability. Verbally reporting pain is the gold standard for pain assessment and in the absence of reportable pain, the extent to which an individual suffers from pain remains unknown. Advanced metastatic cancer was the proxy pain variable in this study and a majority of the residents in the current study had lung, breast, prostate, or renal cancer, which predictably produce painful bone metastases (US Department of Health Human Services, 2004). Despite the presence of bone metastases that are associated with pain in the cognitively intact, opioid administration declined as AD severity worsened, a phenomenon that has much empirical support (Horgas & Miller 2008, Herr *et al.* 2010). Medication administration (opioid, non-narcotic, or psychotropic) was not correlated with decreased numbers of pain behaviours (DBS); however, those analyses are interpreted with caution. The MDS assessment is completed by multiple nurses in many facilities coding these forms; thus we recognize that rater training and bias may impact the information in the MDS (Mentes *et al.* 1999). Despite these multiple providers, the MDS is reliable. Because the MDS assessment is conducted quarterly and with a change in a residents' status, the DBS cannot be used as a daily pain assessment tool. However, the DBS could be useful as an adjunct to a daily pain assessment protocol. A final limitation is that the DBS was developed from the MDS 2.0 and the MDS 3.0 was released in 2010. Notwithstanding these limitations, the significance of these findings lies in the implication that (independent of the scale used) behavioural indicators of pain, especially when used alone, may not be sufficient to assess for pain in people with very severe AD.

Effect of AD on observable pain behaviours

This study's purpose was to assess pain in nursing home residents with mild to very severe AD who died from cancer. People with more severe AD had fewer pain behaviours recorded in the medical record. For example, nine of 12 participants with very severe cognitive impairment (CPS = 6) had no documentation of behavioural pain indicators in the MDS (DBS = 0). Although we cannot make definitive conclusions about the cause of the absence of pain behaviours, this finding is supported by neuropathology research showing that individual brain regions involved with the affective, sensory, and motor response to pain are more strongly affected in late AD.

Clinicians assess for pain in non-verbal or cognitively impaired people by observing pain-related behaviours (Pautex *et al.* 2006) yet, the current findings suggest that people with presumed metastatic cancer pain and severe AD exhibit few signs of discomfort. Thus, without observable pain behaviour, administration of analgesic medication may not occur. One theory for unidentified pain behaviours in severe dementia is that people who are more severely cognitively impaired may exhibit pain behaviours differently or exhibit pain

behaviours that have yet to be described (Herr *et al.* 2010). Individuals with mild AD (CPS = 2) had lower DBS scores than each of the other groups except for those with very severe AD (CPS = 6). However, these individuals were more likely able to self-report their pain, and, thus, their pain was more likely treated. The ability for individuals with mild cognitive impairment to self-report pain is well-established (Ferrell, Ferrell *et al.* 1995, Chibnall & Tait 2001).

Discomfort Behavioural Scale findings from the current study were similar to those of Stevenson *et al.* (2006). Each study had low median DBS scores of 6 and 3, respectively, and both had a modal score of 0. Considering the number of '0' scores in the both studies, a positive score – however, low – on the DBS could indicate pain and should not only trigger pain assessment, but also pain 'treatment' in persons who are non-verbal and severely cognitively impaired. Investigators have shown that observational scales underestimate the severity of pain (Pautex *et al.* 2006). An automatic 'flag' of a positive DBS score could alert the MDS nurse who completes the assessment to report the presence of possible pain to the nurse providing care to the resident. Combining this method with the American Geriatrics Society Panel on Persistent Pain in Older Persons (2002) recommendations for pain assessment could be beneficial to pain treatment in nursing home residents. For example, the DBS adheres to the following sections in the AGS guidelines: section IV recommends that for the older adult with moderate to severe AD, clinicians should assess direct observation of pain behaviours and any unusual behaviour in people with severe AD should 'trigger pain assessment'. The DBS may identify pain behaviours unseen in a routine pain assessment 'triggering' a focused pain assessment (American Geriatrics Society Panel on Persistent Pain in Older Persons, 2002). Moreover, section VI calls for the regular assessment of pain to examine for improvement, deterioration, or complications; whereas VI (b) suggests that the same pain assessment tool be used during each pain assessment (American Geriatrics Society Panel on Persistent Pain in Older Persons, 2002). The MDS/DBS could be used to augment daily pain assessment while adhering to the AGS Panel recommendations because the MDS is a standardized, reliable instrument that is 'mandated' in many nursing homes throughout the world.

Conclusion

Direct observation of pain behaviour is the standard of care for pain assessment in people who are non-verbal and/or have cognitive impairment. However, as AD worsens, observable pain behaviours appear to diminish. A cautious conclusion is that the DBS is unable to identify some types of pain behaviours in people with severe AD, or that more likely, severe AD alters the way in which pain-related behaviours are displayed. Another possibility is that the central nervous system no longer processes and interprets signals from nociceptors as pain in people with severe AD. New methods and protocols are urgently needed for assessment and management of pain in people who cannot verbally or behaviourally report pain. Regardless of cognitive ability, the implications of unidentified and untreated pain are devastating. As for current policy implications, clinicians should be cautious when prescribing pro re nata (PRN) 'as needed' medications to individuals who cannot verbally or behaviourally report pain. One consideration is to use scheduled analgesics for an appropriate time period (possibly determined by provider, caregivers, and family). Several

non-pharmacological (massage, acupuncture) and pharmacologic (opioid, non-narcotic) options for pain treatment exist and fear of adverse side effects should not preclude pain treatment. We suggest that a modified DBS be developed from the MDS 3.0. and that it be used in conjunction with each MDS assessment. Finding ways to identify people at risk for unidentified pain is critical to public health. Future studies are urgently needed that examine the relationship between pain, brain function, and the sensory, affective, and motor aspects of the pain experience.

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What is already known about this topic

- Self-report of pain is the gold standard for pain assessment.
- Direct observation of pain behaviour becomes the standard assessment method in individuals who are non-verbal or severely cognitively impaired.
- Individuals with cognitive impairment consistently receive less pain medication, relative to controls, in the presence of known painful conditions.

What this paper adds

- The current analyses compares people with mild to very severe cognitive impairment in a single study.
- The motor regions of the central nervous system responsible for behaviours related to pain seem to be affected at different times in the course of Alzheimer's disease. People with moderate Alzheimer's disease had significantly more pain behaviours recorded in the medical record than people with very severe Alzheimer's disease.
- Using direct observation of pain behaviour in people with severe Alzheimer's disease as the only method for pain assessment provides limited information.

Implications for practice and/or policy

- The reliability of using observable behaviours as the only method to assess for pain in people with severe Alzheimer's disease is questionable.
- People with all levels of cognitive impairment are at risk for unidentified and under treated pain; however, people with very severe cognitive impairment seem to be at greatest risk.
- In the presence of conditions known to be painful in non-cognitively impaired people, the use of scheduled analgesia should be considered to ensure a therapeutic level of analgesia in people who cannot verbally or behaviourally indicate that they have pain.

Table 1 Sample characteristics ($n = 48$).

Characteristic	<i>n</i> (%)
Gender	
Male	22 (46.0)
Female	26 (54.0)
Race/ethnicity	
White	35 (73.0)
African American	13 (27.0)
Dementia type	
Alzheimer's disease	43 (90)
Vascular dementia	4 (8)
Lewy body dementia	1 (2)
Cancer type	
Colon/rectal	12 (25)
Female breast [†]	12 (25)
Prostate [†]	9 (9)
Lung/bronchiole [†]	6 (12.5)
Other [‡]	9 (9)

 n = number in each sub category.[†] cancers with likely bone metastasis.[‡]Other: Uterine = 2, Melanoma of skin-2, Ovarian = 2, Kidney/Renal = 1, Bladder = 1, Non-Hodgkin's Lymphoma = 1.

Table 2

DBS[‡] scores observed among participants in the CPS Groups (*n* = 48).

CPS [*] score	<i>n</i> ¹	Ranges			Zero scores	
		Minimum	Median	Max	<i>n</i> ² (%)	
2	7	0	0	20	4	(57.1)
3	11	0	6	24	1	(9.00)
4	10	0	0	48	7	(70.0)
5	8	0	0	32	5	(62.5)
6	12	0	0	10	9	(75.0)

*n*¹ = total number of nursing home residents in each CPS group.
*n*² = total number of residents with DBS scores of '0' in each CPS group.

* CPS scores: 0 = cognitively intact, 1 = borderline intact, 2 = mild, 3 = moderate, 4 = moderately severe, 5 = severe, 6 = very severe cognitive impairment.

[‡] DBS (pain behaviour) is scored from 0 to 102.

Difference between DBS scores in CPS categories of 3 and 6 statistically significant; *P* 0.005.

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Table 3

Estimated Spearman's rank correlation coefficients between DBS (pain behaviours), CPS (cognitive ability) and covariates of interest ($n = 48$).

	DBS	CPS	Gender	Age	Cancer type	Total equivalent dose units of opioid	# of doses of non-narcotic medications	# of doses of psychotropic medications
DBS.	-	-0.28	0.05	-0.09	-0.20	0.12	-0.09	0.14
<i>P</i> value	-	0.029 *	0.361	0.273	0.087	0.217	0.271	0.169
CPS	-0.28	-	-0.09	-0.11	-0.16	-0.44	0.03	-0.11
<i>P</i> value	0.029 *	-	0.276	0.223	0.141	0.001 **	0.408	0.223

* correlation is statistically significant at the 0.05 level (1-tailed).

** correlation is statistically significant at the 0.01 level (1-tailed).