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Original Article

Psychometric Evaluation of the MOBID Dementia Pain Scale in U.S. Nursing Homes

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ABSTRACT

Purpose: The Mobilization-Observation-Behavior-Intensity-Dementia (MOBID) Pain Scale is an observational tool in which raters estimate pain intensity on a 0-10 scale following five standardized movements. The tool has been shown to be valid and reliable in northern European samples and could be useful in the United States (US) for research and clinical purposes. The goal of this study was to examine the validity and reliability of the MOBID among English-speaking nursing home residents in the US.
Design: Cross-sectional study.
Settings: Sixteen nursing homes in Pennsylvania, New Jersey, Georgia and Alabama.
Participants: One hundred thirty-eight older adults with dementia and moderate to severe cognitive impairment.
Methods: Validity was evaluated using Spearman correlations between the MOBID overall pain intensity score and 1) an expert clinician's pain intensity rating (ECPIR), 2) nursing staff surrogate pain intensity ratings, and 3) known correlates of pain. We assessed internal consistency by Cronbach's alpha.
Results: MOBID overall scores were significantly associated with expert clinician's rating of current and worst pain in the past week (rho = 0.54, and 0.57; $p < .001$, respectively). Statistically significant associations also were found between the MOBID overall score and nursing staff current and worst pain intensity ratings as well as the Cornell Scale for Depression in Dementia (rho = 0.29; $p < .001$). Internal consistency was acceptable ($\alpha = 0.83$).
Conclusions and Clinical Implications: Result of this study support the use of the MOBID in English-speaking staff and residents in the US. Findings also suggest that the tool can be completed by trained, nonclinical staff.

Roughly half of all nursing home (NH) residents with dementia experience pain (van Kooten, Smalbrugge, van der Wouden, Stek, & Hertogh, 2017b). These high rates are alarming, given the adverse consequences of untreated pain, which include decreased quality of life, diminished physical function, impaired sleep and increased depression, risk for falls, agitation, and aggressive behaviors (Ahn & Horgas, 2013; Corbett et al., 2012; Deandrea et al., 2010; van Dalen-Kok et al., 2015). Regular, accurate pain assessment to identify and monitor pain in persons with dementia is critical in this vulnerable group.

Self-report of pain is widely endorsed as the gold standard for pain assessment, although it can be challenging to obtain this information from those with advanced dementia (Corbett et al., 2014;

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Herr, Coyne, McCaffery, Manworren, & Merkel, 2011). One strategy for identifying and evaluating pain in nonverbal older adults with dementia is the use of observational pain behavior scales. However, experts do not currently recommend one particular tool for clinical practice (Closs et al., 2016; Herr, Zwakhalen, & Swafford, 2017; Lichtner et al., 2014). Systematic reviews examining strengths and limitations for available observation-based pain assessment tools have concluded that more psychometric evaluation and clinical testing of the available tools are needed to support their use (Closs et al., 2016; Herr et al., 2017; Lichtner et al., 2014).

Of the available tools, the Mobilization-Observation-Behavior-Intensity-Dementia (MOBID) Pain Scale has evidence of strong reliability and validity in Norwegian NHs (Husebo, Ostelo, & Strand, 2014; Husebo et al., 2007; Husebo, Strand, Moe-Nilssen, Husebo, & Ljunggren, 2009, 2010) and the tool has been used in studies conducted in the Netherlands (van Kooten, Smalbrugge, van der Wouden, Stek, & Hertogh, 2017a; van Kooten, Smalbrugge, et al., 2017b; van Kooten, van der Wouden, et al., 2017) and Denmark (Tang, Wollsen, & Aagaard, 2016). This instrument is a nurse-administered observational tool and requires that the person is first observed at rest and then guided through five standardized, active movements to capture movement-related pain behaviors, which are then used to make an overall estimate of pain intensity. It has a strong conceptual development and methodologic evaluation, including responsiveness to treatment (Husebo, Ballard, Sandvik, Nilsen, & Aarsland, 2011; Husebo et al., 2007).

Although there is growing psychometric support for MOBID with Northern European NH residents, evaluation of the tool in English-speaking residents and caregivers is lacking. The purpose of this study, then, was to examine the validity and reliability of the MOBID in a sample of English-speaking U.S. NH residents with dementia. We also evaluated the contributions of individual items to the overall MOBID pain intensity score to explore whether or not all required MOBID movements were necessary.

Methods

Setting and Participants

The data for the analyses described in this article were collected as part of a larger study to construct a cost-effective pain observation tool for persons with dementia using items from existing measures. The MOBID was used in that study to assess the validity of the new tool. We recruited participants from four federally owned and operated (Department of Veterans Affairs [VA]) NHs and 12 community NHs in southeastern Pennsylvania, New Jersey, Georgia, and Alabama. Inclusion criteria were that participants (1) resided in a participating VA or community NH for more than 7 days, (2) were 50 years or older; (3) had a diagnosis of dementia documented in the medical record, and (4) had moderately severe to severe cognitive impairment as indicated by a score of $\leq$10 on the Brief Instrument of Mental Status (Chodosh et al., 2008; Saliba et al., 2012). Initially we included residents without regard to pain status because we wanted to develop and evaluate the new pain observation tool among all levels of pain, including absence of pain.

Licensed nursing staff at the participating NHs were asked to identify long-term care residents who were eligible and to contact their legally authorized representatives or powers of attorney to request permission for research staff to contact them with information about the study. Written consent was obtained from legally authorized representatives or powers of attorney and assent was sought from all participants. The Department of Veterans Affairs Central Institutional Review Board approved all study procedures.

Measurements

MOBID Pain Scale

The MOBID assesses the presence of pain and inferred pain intensity at rest and with five standardized guided movements in persons with advanced dementia (Husebo et al., 2007, 2009, 2010; Husebo, Ostelo, et al., 2014). The guided movements are (1) opening both hands; (2) stretching both arms toward head; (3) stretching and bending of both ankles, knees, and hips; (4) turning over in bed to both sides; and (5) sitting at bedside. The rater first observes the person with dementia at rest for 2-3 minutes and then during the five standardized, active movements. For each of the movements and at rest, raters indicate whether or not they observed any of the following pain behaviors: pain noises ("ouch," groaning, gasping, screaming), facial expressions (grimacing, frowning, tightening mouth, closing eyes), and defensive movements (freezing, guarding, pushing, crouching). The raters also estimate pain intensity at rest and for each guided movement using a Numeric Rating Scale (NRS) of 0 (no pain) to 10 (pain as bad as possibly could be). The final step is for the observer to infer an overall pain intensity score using the same NRS based on the ratings for all six MOBID items. According to its developers, 1 hour of training is required to prepare raters to use the MOBID, part 1, and the reported time to complete is less than 5 minutes (Husebo et al., 2007).

With its emphasis on movement-related pain, the original MOBID focused on nociceptive, musculoskeletal pain (Husebo et al., 2009). To capture a broader range of pain experiences, including neuropathic pain and organ-related pain, Husebo et al. (2010) adapted the original tool to create the MOBID-2. The revised tool includes an additional step of having the observer complete a pain drawing and assess pain behaviors and intensity related to internal organs, head, and skin during the prior week. In the present study we used the original MOBID (i.e., part 1 of the MOBID-2) because we were focused on direct, in the moment observation of pain behaviors related to musculoskeletal and nociceptive pain.

The MOBID's psychometric properties have been examined in several studies; however, none was conducted with English-speaking providers in U.S. long-term care settings. Evidence of tool validity has been established through significant associations between MOBID scores and geriatric physicians' pain estimates ($r = 0.61$-0.64) (Husebo et al., 2010), higher overall observed pain intensity (score 4.4, standard deviation [SD] = 1.8) after the MOBID guided movement procedures than after regular care activities (score 3.0, SD = 1.9) (Husebo et al., 2007), and significant strong associations between independent overall pain intensity scores rated on 0-10 NRS and the maximum pain intensity score of the MOBID items ($r = 0.82$) (Husebo et al., 2010).

The MOBID's internal consistency reliability is supported with Cronbach's α ranging from 0.82 to 0.84 and 0.90 to 0.91 (Husebo et al., 2007, 2010). Interrater reliability was good to excellent (intraclass correlation coefficients [ICC] = 0.70-0.96 for the individual items, 0.76-0.82 for the overall pain intensity rating) for the MOBID (Husebo et al., 2007). Test-retest reliability ICCs range from 0.60 to 0.92 (Husebo et al., 2010). The MOBID also had responsiveness to change in detecting decreased pain intensity after a stepwise pharmacologic intervention (Husebo, Ostelo, et al., 2014).

Expert Clinician Pain Intensity Rating

We used an expert clinician pain evaluation as the gold standard against which to evaluate the MOBID. Study team experts (which included experienced geriatric/palliative care nurse practitioners and a doctorally prepared nurse with extensive experience in pain assessment) conducted a comprehensive evaluation using a standardized protocol, which was developed by a multidisciplinary panel of clinical and research pain experts. The protocol consisted

of the following: (1) a chart review to identify pain-related diagnoses and pain assessments and all pain therapies that were ordered and administered; (2) a targeted physical examination; (3) consultation with available licensed nurses, nursing assistants, families, physical therapists, primary care providers, and others to obtain proxy pain assessments; (4) interviews with participants about their pain if they were able to self-report; and (5) observation of the participant during rest and activity. After completion of these five components, the expert rated the participants' current pain and average, worst, and least pain in the past week using a 0-10 Likert scale where 0 was no pain and 10 was the worst pain imaginable (Cleeland & Ryan, 1994).

Nursing Staff Proxy Pain Ratings

Research coordinators interviewed two nursing staff (a licensed nurse and certified nursing assistant [CNA]) who had cared for the resident three or more times in the 7 days before data collection and asked them to rate the participant's pain intensity in the past week on a scale from 0 to 10 (0 = no pain, 10 = pain as bad as it could be) (Cleeland & Ryan, 1994). Both staff members rated the participant's *worst, least*, and *usual* pain intensity in the past week and current pain intensity at the time of data collection.

Cohen-Mansfield Agitation Inventory

The Cohen-Mansfield Agitation Inventory (CMAI) is a nurse-administered tool used to assess frequency of 29 agitated physical and vocal behaviors on a Likert scale (1 = never, 7 = several times per hour) (Cohen-Mansfield, Marx, & Rosenthal, 1989). The total sum score ranges from 29 for no exhibited agitation to 203 for frequent agitation in all categories. The interrater agreement rates for three sets of raters averaged 0.92, 0.92, and 0.88 (Cohen-Mansfield et al., 1989). For the present study, a trained research coordinator completed the CMAI by interviewing the licensed nurse who was responsible for the resident's care plan.

Cornell Scale for Depression in Dementia

The Cornell Scale for Depression in Dementia (CSDD) is a 19-item semistructured interview. Questions cover five categories: mood-related signs, behavioral disturbance, physical signs, cyclic functions, and ideational disturbance. Each item is rated on a 0-2 severity scale (0 = absent, 1 = mild or intermittent, 2 = severe). Scores greater than 10 indicate probable major depression. This scale has been found to have high internal consistency (coefficient α = .84) and sensitivity as well as high interrater reliability (K_w = 0.67) (Alexopoulos, 2002; Alexopoulos, Abrams, Young, & Shamoian, 1988). The licensed nurse who was responsible for the resident's care plan completed the CSDD.

Neuropsychiatric Inventory–Nursing Home, Sleep and Nighttime Disturbances Subscale

The Neuropsychiatric Inventory–Nursing Home (NPI-NH) is a structured interview in which nurse informants report the presence, frequency, and severity of 12 neuropsychiatric symptoms in the previous 4 weeks. Symptom frequency is rated on a scale of 1-4 (1 = occasionally, less than once per week; 2 = often, about once per week; 3 = frequently, several times per week but less than every day; 4 = very frequently, once or more per day or continuously) and severity is on a scale of 1-3 (1 = mild, 2 = moderate, 3 = severe). Psychometrics of the NPI are well established, with a high level of internal consistency (Cronbach's α = .88) and interrater reliability of 93.6%-100% (Cummings, 1997; Cummings et al., 1994; Wood et al., 2000). The Sleep and Nighttime Disturbances subscale has six questions to measure nighttime disruptions of sleep-wake patterns and activity. We calculated the subscale by multiplying the mean frequency score by the mean severity score, yielding a total score range of 0-12. A research coordinator completed the NPI-NH by structured interview either with the night shift nurse or the nurse who oversaw the care of the resident.

Procedures

The investigators trained the research coordinators in the proper administration of all study tools, including the MOBID. Research coordinators were required to achieve a minimum of 80% agreement with the investigators for the MOBID.

Data for all study measures for each participant were collected within 72 hours, with the MOBID observations and the staff and expert ratings of pain occurring within 8 hours. Because the research coordinators were not clinicians, the MOBID was completed based on facility nursing staff availability to assist with moving the resident through the guided movements. The research coordinators also observed the guided movements while CNAs and other staff provided daily care. On occasion, the expert clinician performed the guided movements while the research coordinators completed the MOBID. The expert clinician, however, did not receive or review with the research coordinators the MOBID scores.

Data Analysis

Descriptive statistics were used to describe sample characteristics as means and SD or frequencies. We examined frequencies of observed behaviors (pain noises, facial expressions, and defense) for each MOBID item as well as pain intensity ratings for all MOBID items to identify potential floor and ceiling effects. Using linear regression, we also evaluated contributions of individual items to the MOBID pain intensity score and explored whether all five MOBID movements contributed significantly to the overall pain intensity rating, which generally is used for decision making in research and clinical care (Tang et al., 2016; van Kooten, Smalbrugge, et al., 2017a, 2017b; van Kooten, van der Wouden, et al., 2017).

To assess validity, we first examined the associations between our criterion measure—the ECPIR—and the MOBID pain intensity scores at rest (item 1) and overall pain intensity (item 7) using Spearman correlations (ρ). We correlated the MOBID "at rest" rating with ECPIR "*least* pain in the past week" item and the overall MOBID score with the ECPIR *worst* and *usual* pain in the past week. In addition, we examined Spearman correlations between the MOBID "at rest" and overall scores with similar items on the licensed nurse and CNA pain intensity ratings.

We also used Spearman correlations to examine the associations between overall pain intensity (MOBID item 7) and other study tools that measured constructs that are known to be associated with pain in persons with dementia: depression (CSDD), agitation (CMAI), and sleep disturbances (NPI-NH) (Blytt, Bjorvatn, Husebo, & Flo, 2018; Lukas, Mayer, et al., 2013; Snow et al., 2009). We expected to find low to moderate associations between the MOBID overall pain intensity score and the three tools. We also compared overall pain intensity scores for persons with and without an arthritis diagnosis; because movement-related pain is common in persons with arthritis, we expected to identify higher overall MOBID scores among those with arthritis compared with residents without arthritis. We assessed internal consistency by the Cronbach α coefficient.

In part of the sample, pain intensity ratings for MOBID items 5 and 6 were missing because the research coordinators were unable to observe these movements as they naturally occurred throughout the day or to enlist the assistance of a staff member to guide the

Table 1
Participant Characteristics (N = 138)

	N (%) or Mean ± SD
Age	84 ± 10 (50-107)
Female	63 (45.7%)
Race	
Black or African American	39 (28.3%)
White	99 (71.7%)
Pain diagnosis	
Arthritis, n (%)	74 (53.6%)
Miscellaneous painful diagnoses, n (%)	52 (37.7%)
Constipation, n (%)	43 (31.2%)
Pressure ulcer or painful skin condition, n (%)	34 (24.6%)
Peripheral vascular disease, n (%)	30 (21.7%)
Fracture, contracture, or osteomyelitis, n (%)	24 (17.4%)
Lower GI pain, n (%)	15 (10.9%)
Neoplasm, cancer, n (%)	18 (13.0%)
Neuropathic pain, n (%)	15 (10.9%)
Gout, n (%)	7 (5.1%)
Headache, n (%)	4 (2.9%)
Number of painful diagnoses	2.6 ± 2.2
Pain medications	
Acetaminophen, n (%)	113 (83.1%)
Opioids, n (%)	43 (31.6%)
Anticonvulsants, n (%)	15 (11.0%)
Antidepressants, n (%)	4 (2.9%)
Topical pain medications, n (%)	9 (6.6%)
Nonsteroidal antiinflammatory drugs (NSAIDs)	11 (8.1%)
Any pain medication, n (%)	120 (88.2%)
Cornell Scale of Depression in Dementia (range 0-16)	4.5 ± 3.9
Cohen-Mansfield Agitation Inventory (range 29-89)	42.9 ± 14.0
Neuropsychiatric Inventory–Nursing Home Version Sleep subscale (range 0-6.1)	0.2 ± 0.7

SD = standard deviation; GI = gastrointestinal.

resident in these movements. Thus, in addition to a complete case analysis, multiple imputations were performed to estimate the missing pain intensity data for the two items. Weighted predictive mean matching and random forest imputation methods were selected to represent different imputation assumptions and thus provide a more robust conclusion. The statistical package R Version 3.4.1 (R Foundation for Statistical Computing, Vienna, Austria) was used to conduct all analyses.

Results

Description of the Sample

The characteristics of the 138 participants are summarized in Table 1. Forty-six percent of the participants were women and approximately 72% were white, with a mean age of 84 (SD = 10; range 50-107). On average, participants had approximately three painful diagnoses (range 0-11) and almost 54% had arthritis.

Pain intensity ratings by the expert clinician, licensed staff nurse, and CNA are presented in Table 2. On average, the sample had low pain intensity, and the expert clinicians and CNAs rated pain intensity higher than licensed nurses.

MOBID Items and Summary Statistics

Frequency of pain noises, facial expression, and defense reported for each MOBID item are displayed in Table 3. At rest, raters observed very few pain behaviors. Facial expressions were the most commonly reported category of pain behaviors, occurring in 20%-53% of the five movements, whereas defensive movements were the least reported group of pain behaviors (recorded in only 2%-6% of the guided movements). The highest frequency of pain behaviors occurred with moving the hips and knees and with turning from side to side in bed.

Table 4 describes the summary statistics for the MOBID scores for each of the 7 items. As expected, the mean scores for the MOBID at rest were quite low (0.2; SD = 0.9) and higher for the guided movements, with the highest mean scores for turning both sides in bed (mean = 2.0; SD = 2.3). Mean overall MOBID scores (item 7) also were low (mean = 2.0; SD = 2.0). Similar to earlier studies (van Kooten, Smalbrugge, et al., 2017b; van Kooten, van der Wouden, et al., 2017), we also calculated the proportion of participants with "no pain" (overall MOBID item = 0-2), n = 89, 64%; "mild pain" (overall MOBID item = 3-4), n = 32, 23%; and "moderate to severe pain" (≥5), n = 17, 12% (results not shown).

Validity

The overall MOBID score was significantly associated with ECPIR scores for usual, worst, and current pain (Table 5) (ρ = 0.54, 0.57 and 0.40, respectively; $p < .001$). The correlation between ECPIR least pain and scores for item 1 on the MOBID (pain intensity at rest) were low (ρ = 0.12; $p = .2$). Spearman correlations between the overall MOBID score and the licensed nurse and CNA scores for usual, worst, and current pain were lower than for the ECPIR but also were statistically significant.

The Spearman correlations between the MOBID overall pain intensity scores and known correlates of pain were small and not statistically significant for agitation (ρ = 0.15, $p = .09$) and sleep disturbance (ρ = 0.02, $p = .8$). However, we did find a low but statistically significant association between the overall MOBID score and depression (ρ = 0.29; $p < .001$).

The mean ± SD overall MOBID score was 2.2 ± 2.2 for the 74 patients with an arthritis diagnosis and 1.8 ± 1.8 for the 64 patients without the diagnosis ($p = .2$, two-sample t test).

Reliability

Cronbach α coefficient was .83, demonstrating good internal consistency.

Contributions of Individual MOBID Items

Table 6 includes the results of the regression models in which we examined how much of the overall MOBID score was predicted by different groups of items. The R^2 for all three regression models

Table 2
Pain Ratings by Expert, Licensed Nurse, and CNA

Time Range of Pain Evaluation	Expert		Licensed Nurse		CNA	
	N	mean ± SD (range)	N	mean ± SD (range)	N	mean ± SD (range)
Worst past week, 0-10	135	4.0 ± 2.7 (0.0-10.0)	138	1.9 ± 2.8 (0.0-10.0)	138	3.0 ± 3.3 (0.0-10.0)
Least past week, 0-10	135	0.3 ± 0.9 (0.0-6.0)	138	0.3 ± 1.0 (0.0-5.0)	138	0.9 ± 1.9 (0.0-10.0)
Usual past week, 0-10	136	1.4 ± 1.4 (0.0-8.0)	138	0.9 ± 1.7 (0.0-8.0)	138	1.8 ± 2.6 (0.0-10.0)
Right now, 0-10	136	1.3 ± 1.7 (0.0-9.0)	138	0.5 ± 1.4 (0.0-8.0)	138	1.0 ± 2.2 (0.0-10.0)

CNA = certified nursing assistant; SD = standard deviation.

Table 3
Frequency of Pain Noises, Facial Expression, and Defense on MOBID Items 1-6 (N = 138)

	Demonstrated a Pain Behavior	
	No, N (%)	Yes, N (%)
MOBID 1. At Rest (n = 137)*		
Pain Noises	134 (98%)	3 (2%)
Facial Expression	130 (95%)	7 (5%)
Defense	136 (99%)	1 (1%)
MOBID 2. Guide to open hands (n = 137)*		
Pain Noises	122 (89%)	15 (11%)
Facial Expression	110 (80%)	27 (20%)
Defense	130 (95%)	7 (5%)
MOBID 3. Guide to stretch both arms toward head (n = 135)*		
Pain Noises	115 (85%)	20 (15%)
Facial Expression	91 (67%)	44 (33%)
Defense	128 (95%)	7 (5%)
MOBID 4. Guide to stretch and bend both knees and hips (n = 133)*		
Pain Noises	101 (76%)	32 (24%)
Facial Expression	74 (56%)	59 (44%)
Defense	126 (95%)	7 (5%)
MOBID 5. Guide to turn in bed to both sides (n = 93)*		
Pain Noises	63 (68%)	30 (32%)
Facial Expression	44 (47%)	49 (53%)
Defense	87 (94%)	6 (6%)
MOBID 6. Guide to sit at bedside (n = 111)*		
Pain Noises	86 (77%)	25 (23%)
Facial Expression	82 (74%)	29 (26%)
Defense	109 (98%)	2 (2%)

MOBID = Mobilization-Observation-Behavior-Intensity-Dementia Pain Scale.
* The number completed less than the total sample because the research coordinators completing the MOBID were unable to coordinate with facility staff for a time to observe staff guide the participant through the five movements.

indicated that variance explained did not change considerably when item 1 was dropped.

Discussion

This study provides the first published evidence on the psychometric properties of the MOBID for use with an English-speaking population in the NH setting in the United States. Our findings indicate strong support for the tool's validity and internal consistency reliability. Furthermore, this evidence supports the MOBID's psychometric properties despite the inability of our research coordinators to complete all items in the majority of cases. As such, it also raises some questions as to whether or not all five movements are necessary to assess pain intensity.

Patterns of scoring individual and overall items on the MOBID in the present study were similar to those previously reported. For example, facial expressions were the most commonly identified behaviors across items, followed by pain noises and then defense movements, a finding that matched ours (Husebo et al., 2007). Researchers using other tools have also identified facial expressions as a key pain behavior in this population (Sheu, Versloot, Nader, Kerr, & Craig, 2011). In addition, we found that the most painful guided movements involved moving the legs and hips and turning the person in bed, which is consistent with findings from an earlier study conducted in 18 Norwegian NHs (Husebo, Ostelo, et al., 2014). Because musculoskeletal pain is the most common source of pain in older adults (Centers for Disease Control and Prevention, 2002; Leveille, Zhang, McMullen, Kelly-Hayes, & Felson, 2005), it is not surprising that these guided movements elicit pain behaviors. However, the difference between mean pain scores for persons with and without arthritis was not statistically significant, although average pain scores were higher for those with arthritis compared with residents without the diagnosis (2.2 versus 1.8, respectively).

As confirmed in studies of the original MOBID tool, we found very low scores for item 1 which involves observing for pain behaviors and rating pain intensity while the person is at rest and lying down (Husebo et al., 2007). Moreover, this item had a low correlation ($\rho = 0.14$) with the ECPIR least pain score. These findings support Husebo et al.'s (2010) decision to delete this item in the revised MOBID-2 and instead instruct raters to observe the person first and then complete the items during mobilization.

Some pain observation tools have been criticized for including behaviors that overlap with those related to other conditions (e.g., agitation, depression). We found small nonsignificant associations with related constructs, including agitation, depression, and sleep, which are noted as comorbid conditions in this population. This suggests that the MOBID is measuring behaviors associated with pain rather than other conditions; however, continued efforts to refine pain behavior tools to minimize overlap is needed.

In our sample of English-speaking MOBID users in the United States, the tool was reliable, with good internal consistency with both the smaller complete data set (Cronbach $\alpha = .83$) and with the random forest imputation method (Cronbach $\alpha = .80$). This is consistent with the findings with the original MOBID development among Norwegians (Cronbach $\alpha = .90$-$.91$) (Husebo et al., 2007).

As part of our evaluation, we examined the contribution of the ratings for each of the five movements to the overall MOBID score. It is important to identify which movements are critical to the overall score, because this single item has been used in several studies as the measure that is used to guide and evaluate the effectiveness of pain therapies (Husebo, Ballard, Fritze, Sandvik, & Aarsland, 2014; Husebo, Ballard, Cohen-Mansfield, Seifert, & Aarsland, 2014; Husebo et al., 2011; Sandvik et al., 2014). The R^2 changed very little when we eliminated "at rest" and "Guide to open both hands, one hand at a time" items. This finding further supports the elimination of the "at rest" item in the current version of the MOBID (i.e., MOBID-2) and suggests that perhaps another item might be evaluated for elimination. Although completion of the MOBID in this study took about 5-8 minutes, time constraints are commonly cited as reasons for incomplete pain assessment in NHs (Clark, Jones, & Pennington,

Table 4
Pain Intensity Scores for Individual MOBID Items (Item Range 0-10)

	N	Mean	SD	Mini-mum	Median	Maxi-mum	% > 0
At rest	138	0.2	0.9	0	0	9	6%
Guide to open hands	137	0.8	1.7	0	0	10	25%
Guide to stretch both arms towards head	136	1.2	2.0	0	0	9	38%
Guide to stretch and bend both knees and hips	133	1.8	2.5	0	0	10	47%
Guide to turn in bed to both sides	92	2.0	2.3	0	1.5	10	60%
Guide to sit at bedside	111	1.1	2.0	0	0	8	33%
Overall pain intensity Rating	138	2.0	2.0	0	2	9	64%

MOBID = Mobilization-Observation-Behavior-Intensity-Dementia Pain Scale; SD = standard deviation.

Table 5
Associations of Expert and Staff Pain Intensity Ratings with MOBID at Rest and Overall Pain Intensity

MOBID Variable	Expert Clinician/Licensed Staff Nurse/Certified Nursing Assistant (CNA) Pain Intensity Rating	N	ρ	*p*
At Rest—Intensity*	Expert clinician, least past week, 0-10	135	0.12	.2
At Rest—Intensity*	Licensed nurse, least past week, 0-10	138	0.10	.3
At Rest—Intensity*	CNA, least past week, 0-10	138	0.10	.3
Overall Pain Intensity†	Expert clinician, worst past week, 0-10	135	0.57	<.001
Overall Pain Intensity†	Licensed nurse, worst past week, 0-10	138	0.30	<.001
Overall Pain Intensity†	CNA, worst past week, 0-10	138	0.28	<.001
Overall Pain Intensity†	Expert clinician, usual past week, 0-10	136	0.54	<.001
Overall Pain Intensity†	Licensed nurse, usual past week, 0-10	138	0.24	.004
Overall Pain Intensity†	CNA, usual past week, 0-10	138	0.28	<.001
Overall Pain Intensity†	Expert clinician, now, 0-10	136	0.40	<.001
Overall Pain Intensity†	Licensed nurse, now, 0-10	138	0.38	<.001
Overall Pain Intensity†	CNA, now, 0-10	138	0.27	.001

MOBID = Mobilization-Observation-Behavior-Intensity-Dementia Pain Scale.
* MOBID item 1.
† MOBID item 7; estimated pain intensity after standardized movement protocol.

2004). Thus, to promote adoption for clinical use, pain assessment tools need to be as parsimonious as possible.

We found that the expert nurse and CNAs rated pain higher than licensed nurses. Many factors contribute to observer bias regarding pain intensity and caregivers with closer association and recent knowledge of the person's activities and behaviors are more accurate in judgments about pain intensity (Hadjistavropoulos et al., 2014; Schiavenato & Craig, 2010). The higher ratings of pain from the expert nurse may relate to their careful evaluation of multiple factors and data sources in arriving at their gestalt pain intensity rating or other attitudinal considerations. The MOBID ratings were completed by trained research assistants but were significantly associated with the other raters' pain ratings. For clinical use, the type of staff member completing the behavior observation may influence pain ratings and is a consideration in establishing procedures for observation tool use.

Our study suggests further avenues of investigation for the MOBID as well as other pain observation tools. For example, it will be valuable in future studies to tease out the elements that enhance a pain observation tools accuracy and sensitivity. Specifically, is it a matter of choosing and defining carefully the best of behavioral pain indicators? Research suggests that facial pain expressions may be a strong predictor of pain in this population (Oosterman, Zwakhalen, Sampson, & Kunz, 2016; Sheu et al., 2011), and our findings support that this indicator was the most commonly identified of the three behavior categories in the MOBID. It is not yet clear if there are specific facial descriptors that are most useful in judgment of pain in this population (Lautenbacher, Sampson, Pähl, & Kunz, 2016). Determining the most useful behavior indicators in detecting pain will facilitate refinement of existing tools.

Other considerations in advancing tool refinement include understanding the impact of differences in scaling (i.e., yes/no, 4-point, or 11-point Likert scales) on the tool's validity and reliability. It also will be critical to examine the relative merits of incorporating a clinical judgment of pain in a pain observation tool, which is how the MOBID is constructed. Schiavenato and Craig (2010) argue that several approaches are needed to evaluate pain, whether or not the patient can self-report, and they include pain "displays" as important contributing information. These displays include the pain behaviors that are commonly included in observational tools. Perhaps observing behaviors elicited from guided movements first heightens a clinician's sensitivity and ability to more accurately estimate another person's pain. Future research should address this issue.

It is clear from this and other studies that pain behaviors are best elicited by movement, rather than at rest (Feldt, 2000; Husebo et al., 2007, 2009; Lukas, Barber, Johnson, & Gibson, 2013). Although most tools rely on observation during movements such as activities of daily living, tools such as the MOBID attempt to ensure consistent approaches to eliciting pain behaviors through defined movements and demonstrated higher overall pain scores with the guided procedure compared with regular care activities (Husebo et al., 2007, 2009; Lukas, Barber, et al., 2013). Although this is feasible in research when trained assistants or staff conduct the guided movements for the observer, questions arise regarding ability to recognize behaviors (such as facial grimacing or expressive eyes) if the staff member involved in creating the movement (e.g., turning in bed) is also the observer. In our study, MOBID raters simply observed the residents while a staff member assisted residents to perform the guided movements. This may have contributed positively to the high associations between the MOBID and other pain measures. It is unclear if our results would have been substantially different had the MOBID raters also conducted the movements.

Table 6
Predictive Ability of MOBID Items 1-6 intensities (to Predict MOBID 7): Full Model and Models after Dropping Specific Sets of Items

MOBID 7 predicted by	Complete Data Only (N = 57)		All Data, PMM Imputation Method (N = 138)		All Data, RF Imputation Method (N = 138)	
	R^2	Residual SD	R^2	Residual SD	R^2	Residual SD
1. MOBID 1-6 (all)	0.86	0.86	0.77	1.00	0.85	0.82
2. Drop MOBID 1, "at rest" observation	0.86	0.85	0.76	1.02	0.83	0.85
3. Hands, arms, legs	0.64	1.33	0.62	1.28	0.64	1.24
4. Arms, legs	0.63	1.33	0.61	1.28	0.64	1.24
5. Turn over	0.56	1.43	0.21	1.82	0.52	1.42
6. Sit up	0.37	1.72	0.28	1.74	0.36	1.64

MOBID = Mobilization-Observation-Behavior-Intensity-Dementia Pain Scale; SD = standard deviation; PMM = weighted predictive mean matching; RF = random forest.

Our study found low pain intensity ratings overall (mean for worst pain = 4.0, SD = 2.7) that may have been affected by factors we were unable to control. First, 83% of all residents received acetaminophen, and some received other analgesic medications. This raises the possibility that present pain may have been effectively treated resulting in lower pain intensity ratings on both the MOBID and the expert raters. This does not affect the reliability and validity of the MOBID in this sample but suggests the need to further validate the tool with older persons experiencing greater pain or before and after treatment. Another factor affecting pain intensity ratings is the type of dementia and the stage of dementia. Van Kooten et al. (2017b) and others have documented differences in pain severity based on these factors, and additional research is warranted to better understand these relationships.

In considering the ultimate goal of having a pain behavior observation tool readily adopted into clinical practice in NHs, in particular, issues arise related to accuracy of observation and detection of behaviors by staff members. Limited staffing in this setting may prevent use of a procedure requiring two people engaged in care to perform the roles of movement creator and observer/rater of behavior. For example, the MOBID requires specific movements, rather than observing the resident during activities of daily living (like turning, bathing, range of motion). Moving the resident through guided movements that are in addition to routine clinical activities is likely to be met with resistance by busy nurses and CNAs. However, other issues arise if there are no common approaches to observing behaviors because certain movements clearly elicit more pain behaviors, as reported in this study. Identification of key movements and key behavioral indicators should be ongoing research emphases to support continued tool refinement and increase consistent approaches to identify and assess pain across patients and settings.

Although our study represents the largest and only study to date of the use of the MOBID in a diverse, English-speaking U.S. sample, it has limitations. First, we did not use licensed nurses to complete the MOBID as recommended by the tools developers. However, we did train research coordinators extensively, both in the completion of the MOBID as well as other study measures. In addition, they received training in the manifestations of and clinical approaches to working with NH residents with dementia. Rather than a limitation, our study indicates that nonnurse staff can be trained to complete the MOBID accurately, paving the way for CNAs and other nonlicensed nursing staff members to use the tool clinically. A second limitation stemming from our use of nonclinician raters was the reliance on others to guide the resident through the movements. Because of this need, we did not use clinicians who were specifically trained in the MOBID protocol. On the other hand, the prescribed movements of the MOBID either use active/passive range-of-motion activities or movements the typically occur during regular daily care. As such, nursing assistants have been trained in these techniques, though not specifically for the MOBID. Third, although research coordinators were trained in the use of the MOBID and required to meet an 80% level of agreement with an investigator before commencing independent data collection, we did not evaluate interrater reliability for the MOBID. Earlier studies report good to excellent interrater reliability as indicated by the κ statistics for the presence of pain behaviors and ICC for inferred pain intensity scores (Husebo et al., 2007). Fourth, there is no information on the tool translation process used to publish other MOBID study results in English; thus this study will be the first to establish the psychometrics of a translated English version of the MOBID. Given our findings, it suggests the translation is satisfactory.

Conclusions

As the first study to examine use of the MOBID in English-speaking U.S. NHs, our findings expand recommendations for use of this tool, which was developed and evaluated with good methodology. Our study substantiated the validity and reliability of the MOBID and provides guidance for potential tool refinement. We also raise further questions regarding clinical utility and use in research of this and other pain behavior tools to advance the science to improve pain recognition and assessment in this vulnerable population.

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References

Ahn, H., & Horgas, A. (2013). The relationship between pain and disruptive behaviors in nursing home resident with dementia. *BMC Geriatrics, 13*(14), 1–7.

Alexopoulos, G. S. (2002). *The Cornell Scale for Depression in Dementia: Administration and scoring guidelines*. White Plains, NY: Weill Medical College of Cornell University.

Alexopoulos, G. S., Abrams, R. C., Young, R. C., & Shamoian, C. A. (1988). Cornell Scale for Depression in Dementia. *Biological Psychiatry, 23*(3), 271–284.

Blytt, K. M., Bjorvatn, B., Husebo, B., & Flo, E. (2018). Effects of pain treatment on sleep in nursing home patients with dementia and depression: A multicenter placebo-controlled randomized clinical trial. *International Journal of Geriatric Psychiatry, 33*(4), 663–670.

Centers for Disease Control and Prevention. (2002). Prevalence of self-reported arthritis or chronic joint symptoms among adults—United States, 2001. *MMWR Morbidity and Mortality Weekly Report, 51*(42), 948–950.

Chodosh, J., Edelen, M. O., Buchanan, J. L., Yosef, J. A., Ouslander, J. G., Berlowitz, D. R., Streim, J. E., & Saliba, D. (2008). Nursing home assessment of cognitive impairment: Development and testing of a brief instrument of mental status. *Journal of the American Geriatrics Society, 56*(11), 2069–2075.

Clark, L., Jones, K., & Pennington, K. (2004). Pain assessment practices with nursing home residents. *Western Journal of Nursing Research, 26*(7), 733–750.

Cleeland, C., & Ryan, K. (1994). Pain assessment: Global use of the Brief Pain Inventory. *Annals, Academy of Medicine, Singapore, 23*(2), 129–138.

Closs, S. J., Dowding, D., Allcock, N., Hulme, C., Keady, J., Sampson, E. L., Briggs, M., Corbett, A., Esterhuizen, P., Holmes, J., James, K., Lasrado, R., Long, A., McGinnis, E., O'Dwyer, J., Swarbrick, C., & Lichtner, V. (2016). Towards improved decision support in the assessment and management of pain for people with dementia in hospital: A systematic meta-review and observational study. *Health Services and Delivery Research, 4*(30). https://doi.org/10.3310/hsdr04300.

Cohen-Mansfield, J., Marx, M. S., & Rosenthal, A. S. (1989). A description of agitation in a nursing home. *Journal of Gerontology, 44*(3), M77–M84.

Corbett, A., Husebo, B., Malcangio, M., Staniland, A., Cohen-Mansfield, J., Aarsland, D., & Ballard, C. (2012). Assessment and treatment of pain in people with dementia. *Nature Reviews Neurology, 8*(5), 264–274.

Corbett, A., Husebo, B. S., Achterberg, W. P., Aarsland, D., Erdal, A., & Flo, E. (2014). The importance of pain management in older people with dementia. *British Medical Bulletin, 111*(1), 139–148.

Cummings, J. L. (1997). The Neuropsychiatric Inventory assessing psychopathology in dementia patients. *Neurology, 48*(5 Suppl 6), 10S–16S.

Cummings, J. L., Mega, M., Gray, K., Rosenberg-Thompson, S., Carusi, D. A., & Gornbein, J. (1994). The Neuropsychiatric Inventory comprehensive assessment of psychopathology in dementia. *Neurology, 44*(12), 2308.

Deandrea, S., Lucenteforte, E., Bravi, F., Foschi, R., La Vecchia, C., & Negri, E. (2010). Risk factors for falls in community-dwelling older people: A systematic review and meta-analysis. *Epidemiology*, 658–668.

Feldt, K. S. (2000). The checklist of nonverbal pain indicators (CNPI). *Pain Management Nursing, 1*(1), 13–21.

Hadjistavropoulos, T., Herr, K., Prkachin, K. M., Craig, K. D., Gibson, S. J., Lukas, A., & Smith, J. H. (2014). Pain assessment in elderly adults with dementia. *The Lancet Neurology, 13*(12), 1216–1227.

Herr, K., Coyne, P. J., McCaffery, M., Manworren, R., & Merkel, S. (2011). Pain assessment in the patient unable to self-report: Position statement with clinical practice recommendations. *Pain Management Nursing, 12*(4), 230–250.

Herr, K., Zwakhalen, S., & Swafford, K. (2017). Observation of pain in dementia. *Current Alzheimer Research, 14*(5), 486–500.

Husebo, B. S., Ballard, C., Cohen-Mansfield, J., Seifert, R., & Aarsland, D. (2014a). The response of agitated behavior to pain management in persons with dementia. *The American Journal of Geriatric Psychiatry, 22*(7), 708–717.

Husebo, B., Ballard, C., Fritze, F., Sandvik, R. K., & Aarsland, D. (2014b). Efficacy of pain treatment on mood syndrome in patients with dementia: A randomized clinical trial. *International Journal of Geriatric Psychiatry, 29*(8), 828–836.

Husebo, B., Ostelo, R., & Strand, L. I. (2014c). The MOBID-2 pain scale: Reliability and responsiveness to pain in patients with dementia. *European Journal of Pain, 18*(10), 1419–1430.

Husebo, B. S., Ballard, C., Sandvik, R., Nilsen, O. B., & Aarsland, D. (2011). Efficacy of treating pain to reduce behavioural disturbances in residents of nursing homes with dementia: Cluster randomised clinical trial. *BMJ, 343*, 1–10.

Husebo, B. S., Strand, L. I., Moe-Nilssen, R., Husebo, S. B., & Ljunggren, A. E. (2009). Pain behaviour and pain intensity in older persons with severe dementia: Reliability of the MOBID pain scale by video uptake. *Scandinavian Journal of Caring Sciences, 23*(1), 180–189.

Husebo, B. S., Strand, L. I., Moe-Nilssen, R., Husebo, S. B., & Ljunggren, A. E. (2010). Pain in older persons with severe dementia. Psychometric properties of the Mobilization–Observation–Behaviour–Intensity–Dementia (MOBID-2) pain scale in a clinical setting. *Scandinavian Journal of Caring Sciences, 24*(2), 380–391.

Husebo, B. S., Strand, L. I., Moe-Nilssen, R., Husebo, S. B., Snow, A. L., & Ljunggren, A. E. (2007). Mobilization-Observation-Behavior-Intensity-Dementia pain scale (MOBID): Development and validation of a nurse-administered pain assessment tool for use in dementia. *Journal of Pain and Symptom Management, 34*(1), 67–80.

Lautenbacher, S., Sampson, E. L., Pähl, S., & Kunz, M. (2016). Which facial descriptors do care home nurses use to infer whether a person with dementia is in pain? *Pain Medicine, 18*(11), 2105–2115.

Leveille, S. G., Zhang, Y., McMullen, W., Kelly-Hayes, M., & Felson, D. T. (2005). Sex differences in musculoskeletal pain in older adults. *Pain, 116*(3), 332–338.

Lichtner, V., Dowding, D., Esterhuizen, P., Closs, S. J., Long, A. F., Corbett, A., & Briggs, M. (2014). Pain assessment for people with dementia: A systematic review of systematic reviews of pain assessment tools. *BMC Geriatrics, 14*(1), 138.

Lukas, A., Barber, J. B., Johnson, P., & Gibson, S. J. (2013a). Observer-rated pain assessment instruments improve both the detection of pain and the evaluation of pain intensity in people with dementia. *European Journal of Pain, 17*(10), 1558–1568.

Lukas, A., Mayer, B., Fialová, D., Topinkova, E., Gindin, J., Onder, G., & Denkinger, M. D. (2013b). Pain characteristics and pain control in European nursing homes: Cross-sectional and longitudinal results from the Services and Health for Elderly in Long TERm care (SHELTER) study. *Journal of the American Medical Directors Association, 14*(6), 421–428.

Oosterman, J. M., Zwakhalen, S., Sampson, E. L., & Kunz, M. (2016). The use of facial expressions for pain assessment purposes in dementia: A narrative review. *Neurodegenerative Disease Management, 6*(2), 119–131.

Saliba, D., Buchanan, J., Edelen, M. O., Streim, J., Ouslander, J., Berlowitz, D., & Chodosh, J. (2012). MDS 3.0: Brief interview for mental status. *Journal of the American Medical Directors Association, 13*(7), 611–617.

Sandvik, R. K., Selbæk, G., Seifert, R., Aarsland, D., Ballard, C., Corbett, A., & Husebo, B. (2014). Impact of a stepwise protocol for treating pain on pain intensity in nursing home patients with dementia: A cluster randomized trial. *European Journal of Pain, 18*(10), 1490–1500.

Schiavenato, M., & Craig, K. D. (2010). Pain assessment as a social transaction: Beyond the "gold standard. *The Clinical Journal of Pain, 26*(8), 667–676.

Sheu, E., Versloot, J., Nader, R., Kerr, D., & Craig, K. D. (2011). Pain in the elderly: Validity of facial expression components of observational measures. *The Clinical Journal of Pain, 27*(7), 593–601.

Snow, A. L., Chandler, J. F., Kunik, M. E., Davila, J. A., Balasubramanyam, V., Steele, A. B., & Morgan, R. O. (2009). Self-reported pain in persons with dementia predicts subsequent decreased psychosocial functioning. *The American Journal of Geriatric Psychiatry, 17*(10), 873–880.

Tang, M. M., Wollsen, M. G., & Aagaard, L. (2016). Pain monitoring and medication assessment in elderly nursing home residents with dementia. *Journal of Research in Pharmacy Practice, 5*(2), 126.

van Dalen-Kok, A. H., Pieper, M. J., de Waal, M. W., Lukas, A., Husebo, B. S., & Achterberg, W. P. (2015). Association between pain, neuropsychiatric symptoms, and physical function in dementia: A systematic review and meta-analysis. *BMC Geriatrics, 15*(1), 49.

van Kooten, J., Smalbrugge, M., van der Wouden, J. C., Stek, M. L., & Hertogh, C. M. (2017a). Evaluation of a pain assessment procedure in long-term care residents with pain and dementia. *Journal of Pain and Symptom Management, 54*(5), 727–731.

van Kooten, J., Smalbrugge, M., van der Wouden, J. C., Stek, M. L., & Hertogh, C. M. (2017b). Prevalence of pain in nursing home residents: The role of dementia stage and dementia subtypes. *Journal of the American Medical Directors Association, 18*(6), 522–527.

van Kooten, J., van der Wouden, J. C., Sikkes, S. A., Smalbrugge, M., Hertogh, C. M., & Stek, M. L. (2017c). Pain, neuropsychiatric symptoms, and quality of life of nursing home residents with advanced dementia in the Netherlands: A cross-sectional study. *Alzheimer Disease & Associated Disorders, 31*(4), 315–321.

Wood, S., Cummings, J. L., Hsu, M.-A., Barclay, T., Wheatley, M. V., Yarema, K. T., & Schnelle, J. F. (2000). The use of the Neuropsychiatric Inventory in nursing home residents: Characterization and measurement. *The American Journal of Geriatric Psychiatry, 8*(1), 75–83.