Scandinavian Journal of
Caring Sciences
METHODS AND METHODOLOGIES
doi: 10.1111/j.1471-6712.2009.00710.x

Pain in older persons with severe dementia. Psychometric properties of the Mobilization–Observation–Behaviour–Intensity–Dementia (MOBID-2) Pain Scale in a clinical setting

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Scand J Caring Sci; 2010; 24; 380–391

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Background: To assess pain in older persons with severe dementia is a challenge due to reduced self-report capacity. Recently, the development and psychometric property testing of the Mobilization–Observation–Behaviour–Intensity–Dementia (MOBID) Pain Scale was described using video-recording. The purpose of this article was to present the further development of this instrument. In MOBID-2 Pain Scale, the assessment of inferred pain intensity is based on patient's pain behaviours in connection with standardized, guided movements of different body parts (Part 1). In addition, MOBID-2 includes the observation of pain behaviours related to internal organs, head and skin registered on pain drawings and monitored over time (Part 2).

Objective: The aim of this study was to examine psychometric properties of the MOBID-2 Pain Scale, like inter-rater and test–retest reliability, internal consistency, as well as face-, construct- and concurrent validity.

Subjects and Setting: Patients with severe dementia (n = 77) were examined by 28 primary caregivers in clinical practice, who concurrently and independently completed the MOBID-2 Pain Scale. Characteristics of the patients' pain were also investigated by their physicians (n = 4).

Results: Prevalence of any pain was 81%, with predominance to the musculoskeletal system, highly associated with the MOBID-2 overall pain score (rho = 0.82). Most frequent and painful were mobilizing legs. Pain in pelvis and/or genital organs was frequently observed. Moderate to excellent agreement was demonstrated for behaviours and pain drawings (κ = 0.41–0.90 and κ = 0.46–0.93). Inter-rater and test–retest reliability for pain intensity was very good, ICC (1, 1) ranging 0.80–0.94 and 0.60–0.94. Internal consistency was highly satisfactory; Cronbach's α ranging 0.82–0.84. Face-, construct- and concurrent validity was good. Overall pain intensity by MOBID-2 was well correlated with physicians' clinical examination and defined pain variables (rho = 0.41–0.64).

Conclusion: On the basis of pain behaviours, standardized movements and pain drawings, MOBID-2 Pain Scale was shown to be sufficiently reliable, valid and time-effective for nurses to assess pain in patients with severe dementia.

Keywords: dementia, pain behaviour, pain intensity, pain drawing, psychometric properties.

Submitted 28 March 2008, Accepted 12 March 2009

Introduction

Inadequate assessment and treatment of pain in persons with dementia are considered among the most pressing ethical issues for pain clinicians (1). Pain diagnoses involving somatic nociceptor activities show predominance to musculoskeletal pain due to degenerative conditions, previous fractures and neuropathies (2), and the prevalence of such conditions are increasing with age (3). Also painful diseases from internal organs and skin are common in advanced age, but prevalence data are incomplete, because patients with dementia are often excluded from these studies (4).

Myocardial ischaemia is a frequent cause of cardiac pain and death in the United States and other developed countries (5). In older persons, headaches are commonly reported (6), and irritable bowel syndrome with abdominal

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pain attacks is a frequent complaint (7). Catheter-associated and genitourinary infections are the most common infections in US hospitals and nursing homes (NH) (8). Transitory exacerbations of pain (breakthrough pain) have been found to affect 40–80% of the cancer patients (9), applying also to older patients with dementia. NH patients are at high risk of developing painful pressure ulcer (10), and deceased persons often demonstrate pressure sores (11%), positively correlated with dementia (11).

Systematic assessment of pain is a prerequisite for prescribing any treatment (1). In dementia, this remains challenging due to abstract thinking deficits (12). As self-report abilities are decreased or absent, behavioural observation and proxy rating are recommended (13). Approximately 20 observational scales are available, and some are considered promising (13–15). However, few instruments attempt to assess nociceptive pain systematically by standardized movements (16), and none of the tools focuses on pain behaviours originating from head, internal organs and skin.

Why a new pain assessment scale?

Streiner and Norman (2006) stated that researchers tend to develop new instruments, which is easier than to establish good reliability and validity of existing scales (17).

Although the number of pain scales addressing dementia has increased, not only psychometric properties, but also contents and usability of the measures are questioned (18). According to review of the literature, the Mobilization–Observation–Behaviour–Intensity–Dementia (MOBID-2) Pain Scale represents a new approach, meeting shortcomings of existing scales, by taking at least three substantial aspects into considerations:

1. The MOBID-2 is an extended two-part version of the nurse-administered MOBID Pain Scale, which recently was described regarding development, and validity and reliability testing (19, 20). The MOBID-2 Part 1, the original MOBID, encourages caregivers to assess pain from the musculoskeletal system by observing pain behaviour during five active, guided movements of different body parts with subsequent rating of pain intensity. As patients with pain tend to avoid movements and thereby conceal pain (21), the standardized movements include all body parts. As demonstrated recently, more pain behaviour and higher overall pain intensity scores were unmasked by guided movements, than by regular care activities (19).

2. Pain from internal organs represent frequent complaints in older persons, but may be difficult to diagnose, because it is often widespread, diffuse and poorly described (22). In dementia, assessment of such painful conditions may be even more challenging. An interdisciplinary expert consensus recommends that both movement-evoked exacerbation of nociceptive pain and other types of pain (e.g. cancer, angina and emboli) should be addressed (18). In MOBID-2 Part 2, pain originating from internal organs, the head and skin is registered by caregivers based on pain behaviours monitored over time, localization of pain on pain drawings and inferred pain intensity. The construction of the two-parted MOBID-2 is in line with Hadjistavropoulos et al. (2007), who argued that pain from the musculoskeletal system often co-exists with other co-morbid conditions, implying that disease-modifying therapies are needed to diminish pain. The content validity of the MOBID-2 Pain Scale was recently demonstrated in a cross-sectional NH study (23, 24).

3. Herr et al. (2006) concluded that patients with dementia may not present pain behaviours at all, or use less obvious indicators such as agitation, or aggression. This is of key importance, as prevalence of behavioural disturbances is high in dementia (25). In MOBID-2 Pain Scale, primary caregivers are encouraged to interpret independently each test item as well as the overall pain, judging whether their observations may be related to pain or to behavioural disturbances due to dementia. Usually, observational pain tools estimate total pain intensity by summing scores of separate pain behaviours. Such scoring procedures may be uncertain, especially when aphasia, paresis or Parkinson's disease prevents bodily expressions.

The present study of psychometric properties addressed the following questions: does the MOBID-2 Pain Scale show sufficient reliability (inter-rater, test–retest agreement) when used by caregivers in a clinical setting? Are the items internally consistent? Does the instrument show face validity, concurrent- and construct validity?

Material and methods

Participants

The study site was a 174-bed nonprofit Norwegian NH, including five dementia-assisted living groups and nine long-term care units, a rehabilitation unit and a palliative care unit. Inclusion criteria were: age > 65 years, severe dementia by Mini-Mental State Examination (MMSE < 12) (26), and a regular family visitor or legal guardian. Exclusion criteria were delirium, psychosis, and/or short stay admission (≤4 weeks). In the course of 6 weeks, 215 patients were registered in the NH and 77 patients met the criteria for participation.

For each patient, a set of two nurses (N1 and N2) (N1 = 14; N2 = 14), familiar with the patients' habits having had the responsibility for the patient during the last 4 weeks, performed the pain assessment. Altogether, 14 sets of nurses, comprising 10 Registered Nurses (RNs) and 18 licensed practical nurses (LPNs), participated in the testing of the 77 patients. They received 2 hours briefing, getting basic information regarding dementia and learned about pain originating from the musculoskeletal system, internal organs, head and skin and pain behaviours, as

well as pain drawings. Each nurse practiced the MOBID-2 Pain Scale in a clinical setting in at least three NH patients.

Ethical considerations

Verbal and written informed and presumed consent was obtained in direct conversation with the patient and his legal guardian, usually a family member or advocate, after explaining the aims of the study and its protocol. The study was approved by the Regional Committee for Medical Research Ethics, Western Norway (REK-Vest nr: 190.04), and the Data Inspectorate (nr: 11529).

Design

A cross-sectional design was used to examine inter-rater reliability, internal consistency and face-, construct- and concurrent validity, whereas a longitudinal design was applied to examine test–retest reliability.

Elements of MOBID-2 Pain Scale

The MOBID-2 (Appendix) has been developed by an expert panel, experienced in the treatment and care of older persons with dementia and/or experienced in examination of psychometric properties of pain assessment tools: one RN, one LPN, two physicians, two physiotherapists. Part 1 of MOBID-2 is the initial version, MOBID, which was developed to capture pain from the musculoskeletal system. On the basis of own clinical experience and survey of the literature (13, 27–38) a process of item generation and later reduction was applied, and reliability was tested also based on video-recording, as described in a previous study (19). In this process the items for observation at rest and the item brushing the teeth/mouth care were moved from the test items, because they did not contribute to heighten the Cronbach's α-value. Five active movement items were retained, guide to: (i) open both hands, (ii) stretch both arms towards head, (iii) stretch and bend both ankles, knees and hips, (iv) turn over in bed to both sides and (v) sit at bedside.

Part 2 of the MOBID-2 was developed to capture other types of pain that might originate from (i) the head, mouth and neck, (ii) heart, lung and chest wall, (iii) abdomen, (iv) pelvis and genital organs and (v) skin.

Pain behaviour indicators

Key indicators of pain behaviour were selected, accompanied by explanatory words: pain noises ('This hurts!' groaning, moaning, gasping, screaming), facial expression (grimacing, frowning, tightening mouth and closing eyes), defence (freezing, guarding, pushing and crouching). These aspects of pain behaviour have commonly been included in staff administered instruments (14). In MOBID-2 Part 1, the nurses were encouraged to pay attention to the patient's pain behaviours, observe the patient before starting mobilization, clearly explain what is going to happen, mobilize the patient gently through the activities, reverse the movement immediately if pain behaviour was perceived, rate observation after each activity and tick the boxes for pain noises, facial expression and defence according to observed pain behaviour.

Test procedures

During the first week after the patients' primary caregivers received the 2-hour briefing, they observed and assessed two to three patients each, using the MOBID-2 procedure. A clear explanation about what is going to happen was given to the patient before starting each movement e.g. 'Mrs., can you please open and close your left hand? I will help you!' Then each item (one to five) of MOBID-2 Part 1 was performed by standardized active, guided movements. If the patient was not able to perform the item, for instance by paralysis, the movement was carefully performed by the nurse. Registration of pain behaviour indicators and inferred pain intensity for each item was completed on the line of a Numerical Rating Scale (NRS) (0–10 point scale) (39), answering the question: 'How intense do you regard the pain to be?'.

In MOBID-2 Part 2, the nurses were encouraged to pay attention to observed pain behaviour today or during the last days (1 week), possibly originating from internal organs, head and skin. Such pain behaviour may be caused by a disease, wound, infection and/or injury. To increase nurses' awareness, Part 2 included a pain drawing (front and back) of the human body. The primary caregivers were encouraged to make one or more cross (es) on this pain drawing, according to observed pain behaviour (pain noises, facial expression and defence). Then, each item (6–10) of MOBID-2 Part 2 was performed, answering the question if the patient might experience pain from the internal organs, head and skin. Registration for pain behaviour indicators on the pain drawing and inferred pain intensity for each item was completed by the NRS (39).

Finally, after completion of scoring the 10 separate items, an independent overall pain intensity score was completed, again using the NRS.

To examine inter-rater reliability of MOBID-2, patients were rated concurrently and independently by two groups of nurses (N1 and N2). To examine test–retest reliability, N1 performed the second rating the next day, renamed N1re.

To register the localization of pain on the pain drawings, a scoring template for the body charts was used, comprising 45 regions of the human body (40). Further, the time needed to fill in MOBID-2 was assessed.

Together with a geriatric study nurse, the primary caregivers rated each patient's cognitive function by the MMSE and Clinical Dementia Rating (CDR) (41). Measurements of daily functioning were collected by activities of daily living (ADL) (42) and severity of depressed affect by the Cornell Scale for Depression in Dementia (43).

The NH physicians (n = 4), a geriatrician, a general practitioner, two anaesthesiologists, were responsible for the patients' diagnoses and treatment. The physicians collected the information regarding medical conditions (ICD-10), dementia type, medical treatment and demographic information, based on the patients' medical charts. Medical examinations were performed focusing on pain aetiology and pain localization, following a standard procedure used at the NH. This included observation of pain behaviours in connection with the consultation, palpation for trigger points and active and/or passive movements of the limbs. After examination, another overall pain intensity was suggested, again using the NRS. Blinded for the results, medical examinations were performed at the same day, shortly before MOBID-2 Pain Scale was assessed by the patients' caregivers.

Statistical analyses

The frequency of observing pain behaviour indicators, number and localization of pain on the pain drawing, and the mean and standard deviation (SD) of inferred pain intensity scores, were calculated for each MOBID-2 item and overall pain intensity scores. Patients were defined to be in pain when MOBID-2 items or the overall pain intensity were scored ≥3 on the NRS (39, 44, 45). All statistical analyses were performed with SPSS-13 for Windows (SPSS, Chicago, IL, USA).

Reliability

Pain behaviour indicators and pain drawings. Inter-rater and test–retest agreement of observed pain behaviour indicators and localization of pain sites by marks on the pain drawing were analysed by kappa (κ) statistics (46). This test provides a measure of concordance within and between the raters and is chance corrected. Interpretation of κ was: ≤0.20 (poor), 0.21–0.40 (fair), 0.41–0.60 (moderate), 0.61–0.80 (good), ≥0.81 (very good agreement) (47).

Pain intensity. Inter-rater reliability of the testers' inferred pain intensity score was calculated pairwise for each MOBID-2 item and for overall pain intensity. Test–retest reliability was calculated between the ratings at day 1 and 2. Relative reliability was examined by Intraclass Correlation Coefficient (ICC) model 1,1 (48), which is equivalent to the SPSS-model 'one-way random'. ICC accounts for relative reliability (49) and is based on the idea that if a measurement is reliable, individual measurements within a group will maintain their position within the group on repeated measurement (50). A good spread in scores is required to demonstrate high agreement. Low values of ICC do therefore not necessarily indicate poor agreement, but can also be a consequence of restricted ranges of scores. As reliability cannot be established by ICC alone, the within-subject standard deviation (s_w) was also calculated (51). This standard deviation of repeated measurements on the same subject enables to measure the size of the measurement error.

Internal consistency. Internal consistency of MOBID-2 was examined using Cronbach's α formula. Ideally, the Cronbach's α coefficient of a scale should be >0.7 and <0.9 (52). Internal consistency refers to the degree to which the items that make up the scale are measuring the same underlying construct (53). Corrected item-total correlations and α scores were also calculated when each item was deleted from the MOBID-2. This correlation expresses the degree to which each item correlates with the total score. The term 'if item deleted' compares these values with the final α-value.

Validity

Face validity. In three meetings, the MOBID-2 Pain Scale was presented and discussed in a focus group (two RNs, two LPNs, two physicians and two physiotherapists) experienced in evaluation and management of pain in NH patients. In the first meeting, they debated aspects of pain behaviour indicators, pain drawings and inferred pain intensity scores. Further, in the second meeting, the MOBID-2 design, the instruction for nurses and the formulation of items were discussed. The draft of MOBID-2 was then pilot tested among three patients with severe dementia who were judged to be in pain. In the last meeting, minor changes of the written instructions and the pain drawing were made.

Construct validity. The association between the overall pain intensity score and the maximum item score of MOBID-2 Part 1 and Part 2 assessed by caregivers was calculated by Spearman's Rank Order Correlation (rho). As demonstrated recently (19), the maximum pain intensity among MOBID items was more highly correlated with the overall pain intensity, than the mean pain intensity of all items.

Concurrent validity. The association between the overall pain intensity in MOBID-2 assessed by caregivers and other pain variables derived from physicians' clinical examination, were calculated by Spearman's Rank Order Correlation: (i) number of pain diagnoses, (ii) number of pain localizations, (iii) number of pain medications

according to World Health Organization's analgesic ladder and (iv) pain intensity scores assessed by the physicians.

Results

Participants

Characteristics of the 77 patients with severe dementia are shown in Table 1. Mean age was 84.1 years (SD = 6.9); the majority was female (79%) and widowed (57%). They had a mean of 3.9 ICD-10 diagnoses (SD = 1.5), 1.8 pain diagnoses (SD = 1.5) and 2.0 pain localization (SD = 2.0). Most of the patients (55%) received pain medication daily, including morphine (22%). They had lived in the NH for a mean of 34 months (SD = 25.6).

Mean age of the 28 nurses was 36.9 years (SD = 12.4). They had several years of working experience (mean = 8.3 years, SD = 9.8) and had worked at the NH for the last years (mean = 5.9 years, SD = 6.1).

Table 1 Characteristics of participants (n = 77)

Variables	n *(%)*	*mean ± SD, range*
Age, years		84.1 ± 6.9, 65–103
MMSE[a] score (0–30)		2.4 ± 3.6, 0–11
CDR[b] score (0–18)		16.0 ± 3.2, 7–18
ADL[c] score (0–20)		7.3 ± 3.8, 0–18
Cornell[d] score (0–38)		2.4 ± 3.8, 0–17
ICD[e] diagnoses		
Nervous System	67 (87)	3.9 ± 1.5, 0–7
Cardiovascular	61 (79)	
Musculoskeletal	44 (57)	
Stroke	27 (35)	
Genitourinary	26 (34)	
Pain diagnoses – aetiology		
Arthritis	28 (36)	1.8 ± 1.5, 0–6
Osteoporosis	26 (34)	
Old fracture	24 (31)	
Muscle spasm	14 (18)	
Contracture	13 (17)	
Pain localization		
Hip	24 (31)	2.0 ± 2.0, 0–10
Back	24 (31)	
Shoulder	23 (30)	
Knee	18 (23)	
Foot	11 (14)	
Pelvis	10 (13)	
WHO I[f]	23 (30)	
WHO II[g]	2 (3)	
WHO III[h]	17 (22)	

[a]MMSE score Mini-Mental State Examination, [b]Clinical Dementia Rating, [c]Activities of Daily Living, [d]Cornell Scale for Depression in Dementia, [e]International Classification of Diagnoses, [f,g,h]World Health Organization analgesic ladder (WHO I, peripheral analgesics; WHO II, weak opioid; WHO III, strong opioid).

Pain

In MOBID-2 Part 1, nociceptive pain was observed in 75% of the patients when NRS > 0, and in 58% when NRS ≥ 3. Most frequent and painful were mobilizing the legs, and least when mobilizing the hands (Table 2). A mean of 2.7 pain behaviour indicators was demonstrated per patient. Facial expression was most frequently demonstrated (mean 2.1 per patient), followed by pain noises (mean 1.2) and defence (mean 0.7). Pain intensity and the number of observed pain behaviour indicators increased by re-test.

Concerning Part 2, the prevalence of pain from internal organs, head and skin was slightly less frequent (NRS > 0 = 55% and NRS ≥ 3 = 42%), see Table 2. Most frequently observed and painful was pain that might originate from pelvis and/or genital organs, least localized to heart region, lung and chest wall. Pain drawings were used for more than 40% of the patients, most frequent for pelvis and genital organs, least frequent for the skin (Table 5).

Regarding the overall pain intensity by MOBID-2, the prevalence of any pain was 80.5% when NRS > 0 (mean 3.6), and 63.6% when NRS ≥ 3 (mean 4.1). Pain intensity scores increased at re-test.

Reliability

In MOBID-2 Part 1, moderate to very good inter-rater reliability (κ = 0.41–0.90) for pain behaviour indicators was demonstrated between the groups of N1 and N2, whereas somewhat lower κ-values were demonstrated for test–retest reliability (κ = 0.41–0.83) (Table 3). Most stable were the κ-values for pain noises, lowest for defence. For

Table 2 Pain prevalence (%) by MOBID-2 items, when NRS > 0 and NRS ≥ 3, based on average test data, by nurses (n = 28)

	NRS > 0 %	*Pain intensity (NRS > 0) mean (SD) range*	*NRS ≥ 3 %*	*Pain intensity (NRS ≥ 3) mean (SD)*
Part 1				
Hands	27.3	3.3 (1.2) 2–6	18.2	3.9 (0.9)
Arms	46.7	3.2 (1.4) 1–8	32.5	3.8 (1.1)
Legs	57.1	3.6 (1.5) 1–8	46.7	4.0 (1.3)
Turn over	44.1	3.0 (1.5) 1–7	28.6	3.8 (1.2)
Sit	36.3	3.3 (1.8) 1–8	22.1	4.3 (1.5)
Part 2				
Head, mouth, neck	24.7	2.8 (1.0) 1–5	15.6	3.4 (0.7)
Heart, lung, chest wall	16.9	2.9 (1.2) 1–5	11.7	3.6 (0.7)
Abdomen	27.3	3.3 (1.9) 1–8	16.9	4.4 (1.6)
Pelvis, genital organs	29.9	3.4 (1.5) 1–7	20.8	4.2 (1.2)
Skin	22.1	3.1 (2.2) 1–10	14.3	4.1 (2.2)
Overall pain intensity	80.5	3.6 (1.5) 1–8	63.6	4.1 (1.3)

Table 3 Inter-rater and test–retest reliability of pain behaviour indicators in Part 1of MOBID-2, assessed by two groups of nurses N1 (n = 14) and N2 (n = 14), by Kappa statistics (κ)

	Hands	*Arms*	*Legs*	*Turn over*	*Sit*
	κ				
Inter-rater reliability					
Pain noises	0.78	0.75	0.82	0.79	0.88
Facial expression	0.90	0.85	0.73	0.64	0.69
Defence	0.66	0.57	0.44	0.78	0.79
Test–retest reliability					
Pain noises	0.83	0.56	0.47	0.80	0.68
Facial expression	0.83	0.42	0.68	0.43	0.42
Defence	0.41	0.56	0.42	0.64	0.60

Table 4 Inter-rater reliability for pain intensity scores and test–retest reliability at day 1 and 2 for MOBID-2 examined as pairwise relative reliability by Intraclass Correlation Coefficient (ICC 1,1), and absolute reliability by within-subject standard deviation (s_w)

	Inter-rater reliability		*Test–retest reliability*	
	ICC(1, 1)	s_w	*ICC(1, 1)*	s_w
Part 1				
Hands	0.93	1.5	0.92	1.0
Arms	0.94	0.9	0.78	1.3
Legs	0.92	1.7	0.60	2.2
Turn over	0.90	1.1	0.89	0.5
Sit	0.93	1.6	0.81	1.0
Part 2				
Head, mouth, neck	0.94	1.1	0.82	0.2
Heart, lung, chest wall	0.86	0.4	0.88	0.4
Abdomen	0.82	1.7	0.61	1.4
Pelvis, genital organs	0.91	0.2	0.79	1.5
Skin	0.80	0.8	0.94	1.0
Overall pain intensity	0.94	1.7	0.92	1.2

pain intensity, excellent relative inter-rater reliability, ICC (1, 1) ranging 0.90–0.94 was demonstrated with highest ICC values for active, guided movements of arms and lowest for turning over in bed (Table 4). Somewhat lower ICC values were achieved for test–retest reliability (ICC = 0.60–0.92).

Good to excellent inter-rater reliability for pain intensity was demonstrated in MOBID-2 Part 2 (ICC = 0.80–0.94), with the highest ICC values for the observation of pain in the head region, mouth and neck (Table 4). Lowest ICC values were demonstrated for the skin. Test–retest reliability was found to be somewhat lower (ICC = 0.61–0.94). Moderate to good inter-rater reliability for pain drawings (κ = 0.46–0.80) was demonstrated, with somewhat higher κ-values for test–retest reliability (κ = 0.48–0.93) (Table 5). Highest inter-rater and test–retest reliability were demonstrated for pelvis and genital organs (κ = 0.80 and 0.93), lowest for head, mouth and neck (κ = 0.46 and 0.66). Higher inter-rater and test–retest reliability were achieved for pain localization by marks on the front body chart (κ = 0.70 and 0.76), than on the back (κ = 0.58 and 0.54) (Table 5).

Table 5 Pain prevalence (%) on the pain drawing of MOBID-2 Part 2 and inter-rater and test–retest reliability by Kappa statistics (κ), assessed by nurses (n = 28)

	Pain prevalence %	*Inter-rater reliability* κ	*Test–retest reliability* κ
Head, mouth, neck	14.2	0.46	0.66
Heart, lung, chest wall	10.7	0.53	0.48
Abdomen	11.4	0.78	0.65
Pelvis, genital organs	16.9	0.80	0.93
Skin	7.4	0.57	0.61
Pain drawing front	31.0	0.70	0.76
Pain drawing back	14.8	0.58	0.54

Internal consistency of MOBID-2 items was shown to be high (Cronbach's α ranging 0.84–0.82) (Table 6). Most items were moderately or highly correlated to the total α-value. No item seemed necessary to eliminate due to negative impact on the total α-value.

Validity

Face validity. Key comments from the focus group were: (i) Judgement of a demented patients' pain experience

Table 6 Internal Consistency of MOBID-2 expressed by item-total correlation (Pearson's *r*), Cronbach's α if item deleted and Cronbach's α total

	N1 (n = *14*)		*N2* (n = *14*)	
	r	α *if item deleted*	*r*	α *if item deleted*
Part 1				
Hand	0.40	0.84	0.42	0.82
Arm	0.52	0.82	0.41	0.80
Legg	0.67	0.82	0.67	0.79
Turn	0.63	0.82	0.47	0.79
Sit	0.66	0.81	0.36	0.80
Part 2				
Head, mouth, neck	0.20 (ns)	0.85	0.35	0.83
Heart, lung, chest wall	0.28	0.83	0.38	0.81
Abdomen	0.41	0.84	0.34	0.83
Pelvis, genital organs	0.58	0.82	0.51	0.79
Skin	0.31	0.84	0.31	0.82
Cronbach's α total	0.84		0.82	

ns, not significant.

Table 7 Correlation between the physicians' mean ratings of pain examination versus nurses' mean ratings of overall pain intensity scores using MOBID-2, calculated by Spearman's Rank Order Correlation (rho)

	N1 mean (n = 14)	*N2 mean (n = 14)*
Physician mean (n = 4)	*rho*	
Number of pain diagnoses	0.48	0.50
Number of pain localizations	0.51	0.52
Number of pain medications	0.41	0.53
NRS	0.61	0.64

rho = 0.29 corresponds to $p < 0.01$ for 77 patients. NRS, Numerical Rating Scale.

will always be challenging, especially when pain stems from the head, internal organs and skin. Caregivers are neither able nor authorized to investigate these areas. To capture such pain, observation of pain behaviour should probably be monitored by the caregivers over time. (ii) It should be a prerequisite that the rater is familiar with the patient's usual behaviour. (iii) All items of MOBID-2 were considered relevant and important, the design and instruction precise and manageable, and the assessment tool was considered motivating and feasible for the staff to use in a clinical setting. The focus group maintained that the instrument seemed well-suited to identify the prevalence of nociceptive and other types of pain. Some minor suggestions for change in the layout were made.

Construct validity. The overall pain intensity scores of MOBID-2 showed higher association with maximum pain intensity scores by Part 1 items (rho = 0.82) than by Part 2 items (rho = 0.61).

Indication of *concurrent validity* was provided, as the overall pain intensity assessed by MOBID-2 was found to be moderately to highly associated with physicians' pain evaluations, rho ranging 0.41–0.64 (Table 7). MOBID-2 seemed to be time-efficient in use (mean 4.37 minutes, range 2.0–7.0).

Discussion

On the basis of pain behaviours and inferred pain intensity, the MOBID-2 Pain Scale was constructed to assess nociceptive and other types of pain in older persons with dementia, by nursing staff. The present study provides evidence of inter-rater and test–retest reliability of pain behaviour indicators, pain intensity scores of test items, pain drawings, and the overall pain score of MOBID-2. Indications of face-, construct- and concurrent validity were demonstrated.

Prevalence and intensity of pain

The prevalence of nociceptive pain (NRS ≥ 3 = 58%) in MOBID-2 Part 1 was more frequently observed than pain probably originating from internal organs (NRS ≥ 3 = 42%) in MOBID-2 Part 2. Most frequently occurring, and with highest pain intensity, were mobilizing legs, in line with high frequency of pain related to musculoskeletal system as registered in patients' medical records. In primary health care, pain related to knees and shoulders is a frequent complaint (54). In Part 2, pain referred to pelvis/genital organs was most frequently observed and painful. This makes sense because irritable bowel syndrome (7), urinary colic, infections and urethral stones (55) have been found to cause recurrent pain attacks. Cardiovascular disorders were also frequently diagnosed in our sample by medical chart, but prevalence and intensity of such pain, registered by MOBID-2, were rather low. Older persons lack typical symptoms of cardiac diseases and retrosternal chest pain (56). Defective ischaemia warning system may be the reason for painless angina pectoris (57), and possibly explain why such pain seldom was registered in our study.

A good range of inferred pain intensity scores was demonstrated for most test items, showing the scale's ability to register various levels of pain. A ceiling effect was shown for one item only, by one patient (skin) scoring 10. By overall pain intensity of MOBID-2, 64% of patients were found to have pain defined as NRS ≥ 3, but in general, the mean pain intensity scores were rather low. An explanation could be that 55% of the patients received analgesics regularly (22% morphine). The fact that this NH has a palliative care unit with physicians and caregivers skilled in pain treatment might have influenced the findings. Using MOBID-2 Pain Scale in a larger cross-sectional study, it was recently shown that patients with dementia demonstrate a complex picture of suffering, including a high number of diagnoses and possibly under-treatment of pain, especially in severe dementia and mixed dementia (23). It was concluded that multi-morbid patients with dementia are in the need of a comprehensive approach of pain assessment and treatment in a multidisciplinary perspective.

Reliability

Moderate to excellent inter-rater reliability for pain intensity scores, based on pain behaviours, was demonstrated for all MOBID-2 items. Rating was performed by a broad group of primary caregivers, providing more generalizable results than commonly reported, where only two or a few raters tested the subjects. Test–retest reliability was also moderate to excellent for most items, but was low for two items (legs and abdomen). The internal consistency of MOBID-2 Pain Scale was found to be highly satisfactory

($\alpha = 0.84$), but it was lower than the Cronbach's α of the initial MOBID Pain Scale (ranging from 0.90 to 0.91) (19). The items for head and skin showed a lower item-total correlation, between 0.20 and 0.35, and it was considered whether they should be discarded from the tool. However, using the normal rule of thumb formulated by Streiner and Norman, (2006), the items were retained as they had an item-total correlation of at least 0.20 (17). These items were seldom scored with little spread in pain intensity and thereby had little impact on the α-value. Furthermore, it was considered important to register pain from all body parts.

Pain behaviour indicators

Facial expression was the most frequently observed pain behaviour, followed by pain noises and defence. Compared with results from a previous study using video-recording (19, 20) nurses in the present clinical study tended to observe less pain behaviour, but obtained even better inter-rater and test–retest reliability. One may speculate, whether scoring by video-recording over-estimates pain observations, or whether 'hands on' situations under-estimate them. Increasing numbers of psychometric property studies include video-recording, and further research is needed to determine which testing situation is most valid.

Pain drawing

Pain drawing is commonly applied to register pain localization (58), showing moderate to high reliability (40). MOBID-2 is the first pain scale for demented persons where proxies are encouraged to use a pain drawing to suggest localization of pain, based on behavioural observations. As pain from internal organs, head and skin may be difficult to capture, the use of pain drawings were introduced to increase caregivers' awareness. Highest scores were related to items of pelvis and/or genital organs, and lowest to skin, with moderate to good inter-rater reliability. Discriminating pain originating from abdomen and pelvis may be difficult, and merging these two items could simplify the scoring.

Validity

One of the most difficult aspects of validity testing is the terminology, including face validity, construct- and concurrent validity (17). There is no simple, absolute, direct test of validity, and there is a risk of thinking of a measurement as being either valid or invalid.

With respect to face validity, the focus group requested that items should be related to the musculoskeletal system as well as internal organs, head and skin. The group underlined, however, that the judgement of a demented patient's pain experience will always be challenging, and required that the rater is familiar with the patient's usual behaviour (59). Also the assessment of discomfort in advanced Alzheimer patients (34) and the Abbey (27) pain scales encourage the rater to assess pain from internal organs. These scales are not based on defined pain behaviours, do not include skin problems, which are frequent health problems in the NH, and do not discriminate between pain from the musculoskeletal system and other types of pain.

Investigating construct validity, it was demonstrated that items in both Part 1 and Part 2 of the MOBID-2 Pain Scale were satisfactorily correlated with the overall pain score. That Part 1 items were more highly associated with the overall pain intensity scores (rho = 0.82) than Part 2 items (rho = 0.61), makes sense, because the prevalence of nociceptive pain was more frequently observed than pain probably originating from internal organs or the skin.

The present study provides support for concurrent validity of the MOBID-2 Pain Scale, as there was an association between the overall pain intensity assessed by nurses and other variables related to pain (number of pain diagnoses, pain locations and pain medications) assessed by physicians. Furthermore, the overall MOBID-2 pain intensity scores were related to the intensity score assigned by physicians using the NRS.

Limitations

In MOBID-2, three key indicators of pain behaviour were chosen, accompanied by 12 explanatory words. One might argue that more behavioural indicators should be included in the scale. More subtle nonverbal indicators like changes in interpersonal interactions, mental status, activity patterns and routines, are recommended (28). While considered important, it was speculated, whether it is possible to discriminate between psychiatric disturbances related to dementia, pain behaviours and behavioural changes in general. Pain tends to fluctuate during a 24-hour period, influenced by change in the patient's general condition and psychosocial factors. Functional items like sleep, appetite and social contact tend to be affected by pain, but may also depend on several other factors. Rare use of these items has been demonstrated and low reliability and validity (60, 61). However, future research should explore the impact of pain on behavioural disturbances in patients with dementia, and investigate the effect of pain treatment.

Another limitation of the scale is related to the concept of pain assessment, which is mainly based on localization, intensity and duration (62). The differentiation between acute and chronic pain is not accomplished in the MOBID-2 Pain Scale. One may speculate, whether long-term pain provoked by mobilization should be defined as chronic or acute pain, or rather acute episode of chronic pain? Such differentiation is of key importance, as the duration of pain has high impact on the expectation of pain treatment (62),

and the fact that 94% of older persons with pain are experiencing chronic pain (63).

Our findings are based on data from only one NH, and external validity regarding other NHs might be questioned, as pain assessment, pain treatment and conditions for the staff may be different. Therefore, one should be cautious about general extrapolation of the study finding to other NHs and primary care.

Future perspectives

The judgement of a demented patient's pain experience by a proxy rater will always be challenging, and should be substantiated by physicians who can perform thorough examinations. The aim of the MOBID-2 procedure is to disclose a possible pain problem and to give the staff an assessment instrument as a prerequisite for pain management. We experienced that health care professionals showed high interest in the development and the framework of the MOBID-2 Pain Scale. Standardized training in pain assessment as well as treatment in dementia was required. In the present study, the participating caregivers' awareness, competence and engagement seemed to increase noticeably, underlining the need for implementation of research results in NHs. The procedure of pain assessment by the MOBID-2 Pain Scale seems to be an adequate alternative in NHs, allowing caregivers to observe the demented patients' pain behaviour on a daily basis.

Conclusion

The MOBID-2 Pain Scale shows a new method for evaluating patients' behaviour that might be caused by pain related to the musculoskeletal system and internal organs, head and skin. Moderate to excellent kappa agreement was demonstrated for pain behaviour and pain drawings. In addition, moderate to excellent inter-rater and test–retest reliability was shown for pain intensity. Associations between nurses' ratings of patients' overall pain intensity by MOBID-2 and physicians' clinical examination were high. This is of key importance, because the majority of patients with dementia and dying patients will suffer from cognitive failure before death. To obtain more knowledge and understanding about the relationship between pain and behavioural disturbances in dementia, further research will be undertaken to systematically follow elderly persons with dementia in the NH. Efforts will be made to assess whether pain assessment by MOBID-2 and individual pain management can improve behavioural disturbances in these frail elderly patients.

Acknowledgements

The authors thank the patients, the relatives and the multidisciplinary team of the Red Cross Nursing Home, Bergen, Norway for their willingness and motivation that made this study possible. Especially, we thank Alfhild Karlsen for the excellent organization of the data collection in the NH, and Aase Huus for designing the MOBID-2 questionnaire.

Author contributions

BSH and SBH had the idea and developed the original protocol and secured the funding. BSH, LIS, RMN, SBH and AEL were responsible for the conception and organization of the study. BSH organized the collection of the data. BSH and RMN did the statistical analyzes. BSH wrote the first draft of the manuscript. BSH, LIS, RMN, SBH and AEL contributed substantially to interpreting the data, revised the draft critically for important intellectual content and approved the final version of the paper. BSH and AEL are guarantors for the paper.

Funding

This study was supported from the Norwegian Foundation for Health and Rehabilitation (2003/2/0096) and the Kavli's Research Center for Dementia.

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Appendix

APPENDIX

MOBID–2 Pain Scale

MOBILIZATION – **O**BSERVATION – **B**EHAVIOUR – **I**NTENSITY – **D**EMENTIA

Patient´s name: **Date:** **Time:** **Unit:**

Pay attention to the patient´s pain behaviour during morning care. Observe the patient before you start mobilization. Explain clearly what is going to happen. Guide the patient carefully through the activities 1–5. Reverse the movement immediately if pain behaviour is perceived. Rate your observation after each activity:

Pain Behaviour

Tick the boxes for Pain noises, Facial expression and Defence, whenever you observed such pain behaviour



Pain noises	**Facial expression**	**Defence**
Ouch!	Grimacing	Freezing
Groaning	Frowning	Guarding
Gasping	Tightening mouth	Pushing
Screaming	Closing eyes	Crouching

YOU MAY TICK SEVERAL BOXES FOR EACH ACTIVITY

Pain Intensity

Based on pain behaviour, rate the pain intensity with a cross on the lines (0–10)

HOW INTENSE DO YOU REGARD THE PAIN TO BE?
0 is no pain and 10 is as bad as it possibly could be

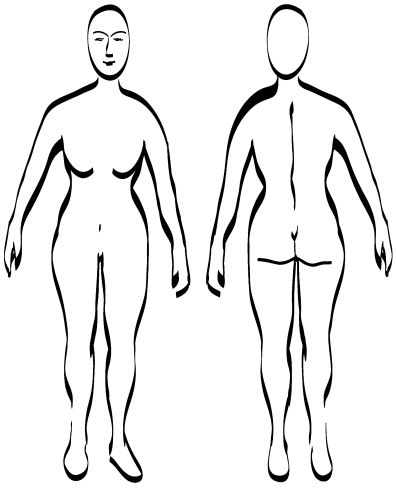
				0	1	2	3	4	5	6	7	8	9	10
1. Guide to open both hands, one hand at a time	☐	☐	☐											
2. Guide to stretch both arms towards head, one arm at a time	☐	☐	☐											
3. Guide to stretch and bend both knees and hips,one leg at a time	☐	☐	☐											
4. Guide to turn in bed to both sides	☐	☐	☐											
5. Guide to sit at the bedside	☐	☐	☐											

APPENDIX

Did you observe, today or in the last days (one week), that the patient expressed pain behaviour related to head, internal organs and/or skin, which may be caused by a disease, wound, infection and/or injury?

Pain Behaviour

Make one or more cross/es on the pain drawing (front and back), according to observed pain behaviour (Pain noises, Facial expression and Defence)



Pain Intensity

Based on pain behaviour, rate the pain intensity with a cross on the lines (0–10)

HOW INTENSE DO YOU REGARD THE PAIN TO BE?
0 is no pain and 10 is as bad as it possibly could be

6. Head, mouth, neck

0 1 2 3 4 5 6 7 8 9 10

7. Heart, lung, chest wall

0 1 2 3 4 5 6 7 8 9 10

8. Abdomen

0 1 2 3 4 5 6 7 8 9 10

9. Pelvis, genital organs

0 1 2 3 4 5 6 7 8 9 10

10. Skin

0 1 2 3 4 5 6 7 8 9 10

Based on all observations, rate the patient's overall pain intensity

0 1 2 3 4 5 6 7 8 9 10

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