

ERRATUM

Open Access



Erratum to: Association between pain, neuropsychiatric symptoms, and physical function in dementia: a systematic review and meta-analysis

Annelore H. van Dalen-Kok^{1*}, Marjoleine Pieper^{1,2}, Margot de Waal¹, Albert Lukas³, Bettina S. Husebo^{4,5} and Wilco P. Achterberg¹

The original version of this article unfortunately contained some mistakes. The presentation of Table 2, Table 5 and Table 6 was incorrect. The corrected tables are given below.

* Correspondence: a.h.van_dalen@lumc.nl

¹Department of Public Health and Primary Care, Leiden University Medical Centre, Hippocratespad 21 Post zone V0-P, PO Box 9600, Leiden, RC 2300, The Netherlands

Full list of author information is available at the end of the article



Table 2 Measurements of pain, neuropsychiatric symptoms and physical function

First author	Measurement of pain		Measurement of neuropsychiatric symptoms		Measurement of function	
	Rating scale	Method of detection	Rating scale	Method of detection	Rating scale	Method of detection
Ahn 2013 ³⁶	MDS pain severity scale, combining pain frequency and pain intensity	Self-report, if not possible staff report based on proxy reports	MDS subscales; wandering-item, aggression behaviour scale (ABS), challenging behaviour profile (CBP) agitation subscale	Patient self-report, proxy and professional	MDS-ADL long form (7 items)	Staff observation
Bartels 2003 ⁸	No use of rating scale	Data collection instrument (3-month period), raters unknown	MDS for depression	Medical records	MDS (number of ADLs)	Medical records
Black 2006 ³⁹	No use of rating scale	Medical records, preceding 6 months, interview surrogate and physician	No use of rating scales	Medical records, preceding 6 months, interview proxy and staff	No use of rating scale	Medical records, preceding 6 months, interview proxy and staff
Brummel-Smith 2002 ⁴⁰	1 out of 3 scales: faces or line scale, or word-based pain intensity scale	self-report, assessed by trained research assistants	No use of rating scales	Trained research assistants	No use of rating scale	Trained research assistants
Cipher 2004 ⁴	GMPI pain and suffering subscale	Part of neuropsychological evaluation by a licensed clinical geropsychologist	-GDS-15 "-26 dysfunctional behaviours with scores "1-7"	Part of neuropsychological evaluation by a licensed clinical geropsychologist	PRADLI	Part of neuropsychological evaluation by a licensed clinical geropsychologist
Cipher 2006 ⁴¹	GMPI	Part of neuropsychological evaluation by a licensed clinical geropsychologist and each instrument was administered after interviewing the resident, nursing staff and family members	GLDS, 19 categories with scores 1-7	Part of neuropsychological evaluation by a licensed clinical geropsychologist and each instrument was administered after interviewing the resident, nursing staff and family members, Medical records, preceding 6 to max 26, Months	GLDS	Part of neuropsychological evaluation by a licensed clinical geropsychologist and each instrument was administered after interviewing the resident, nursing staff and family members
D'Astolfo 2006 ⁴⁴	No use of rating scale	Medical records, preceding 6 to max 26 months	No use of rating scales		No use of rating scale	Medical records Ambulatory status: independent, requires assistance, wheel chair (or bedridden n=?1)
Gruber-Baldini 2005 ⁴⁵	PGC-PIS, score ≥ 2	Rating by supervisory staff member	CSDD CMAI	Rating by supervisory staff member	MDS; activities of daily living scale, SMOI	Rating/observation by supervisory staff member
Kunik 2005 ³⁰	PGC-PIS, item on level of pain in previous week, scores 1-6	Interview with patient and proxy by trained interviewer/research assistant	CMAI HAM-D NPI (subdomains delusion/hallucinations)	Interview with patient and proxy by trained interviewer/research assistant	-	-
Leonard 2006 ⁵⁰	MDS pain burden using a 4-level composite score based on pain	-	MDS (Physical aggression: MDS item 'others were hit, shoved, scratched, sexually abused'; Depression: MDS score ≥ 3 on sum of 9 items, e.g.	-	-	-

Table 2 Measurements of pain, neuropsychiatric symptoms and physical function (Continued)

	frequency and intensity		'being sad', 'making negative statements', 'persistent anger with self or others', 'pained facial expressions'. (At least once in week before)			
Leong 2007 ³⁵	PAINAD for non-communicative patients	Interviews with patient and staff member by professionals for communicative patients	Depression with GDS-15 or STAI Anxiety with Cornell	Self-report or staff report	AAS	Not reported
Lin 2011 ⁴⁶	PAINAD-Chinese version	Observation immediately following instances of routine care by principal investigator and research assistant	No use of rating scales	Medical records and observations by professional	No use of rating scale	Medical records and observation by professional
Morgan 2012 ⁴⁷	PGC-PIS worst pain item	Not reported	CMAI aggression subscale CMAI non-aggressive physical agitation subscale HAM-D depression	Not reported	-	-
Norton 2010 ⁴²	PPQ, intensity item, 10–14 day baseline	Primary CNA and data used from medical records	RMBPC-NH, selection of 3 need driven behaviours, BEHAVE-AD	Primary CNA and unit staff	PSMS	Nurses and trained research assistants
Shega 2005 ⁴⁸	VDS, 1 item on presence and severity of pain 'right now'	Interviews with patients and caregivers by trained research assistant	GDS-15 CMAI	Interview patient and proxy	KATZ IADL	Interview patient and proxy
Shega 2010 ⁴⁹	VDS, 5 point, 'pain past 4 weeks'	Interviews with patient by trained research assistant	Mental Health screening questionnaire; 5-item and 6 point scale	Interview with patient by trained research assistant	OARS/IADL; 3 point scale	Interview patient by trained research assistant
Torvik 2010 ⁴⁸	VRS, 4 point, 'pain right now'	Patient self-report	DQoL, 29-items on 5 domains: self-esteem, aesthetics, positive affect, negative affect, belonging	Not reported	Barthel	Self-report and medical records
Tosato 2012 ³	InterRAI LTCF	InterRAI LTCF questions and observation of behaviour, any type of pain or discomfort of the body in previous 3 days by trained (research) staff	InterRAI LTCF 5 behavioural symptoms, previous 3 days	Not reported	MDS ADL Hierarchy Scale	Data recorded by study physicians
Volicer 2009 ³⁷	MDS-RAI pain frequency (item J2a)	Combination of physical examination, patient history, observation, consultation caregiver and medical records by staff	MDS Depression Rating Scale MDS item J1e for delusions MDS item J1i for hallucinations	Combination of physical examination, patient history, observation, consultation caregiver and medical records by staff	-	-
Volicer 2011 ⁵¹	MDS	Combination of physical examination, patient history, observation, consultation	MDS items I1ee, E1a, E1d, E1f, E1b, E1i, E1l, E1m for depression	Combination of physical examination, patient history, observation, consultation caregiver and medical records by staff	-	-

Table 2 Measurements of pain, neuropsychiatric symptoms and physical function (Continued)

		caregiver and medical records by staff	MDS for delusions and hallucinations MDS items B5b, E1b, E4aa, E4da for agitation			
Williams 2005 ⁴³	PGC-PIS, score =2, and 0–10 pain numeric rating scale	Registered nurses or licensed practical nurses and interview with overseeing supervisor	CSDD, score =7 CMAI, any behaviour at least weekly	Rating by care supervisors, registered nurses and licensed practical nurses	MDS-ADL APAS SMOI	Rating by care supervisors, registered nurses and licensed practical nurses
Zieber 2005 ³⁸	DS-DAT, and a 7-point pain rating scale	Trained facility nurses, palliative care nurse consultants	PAS	Trained facility nurses	-	-

Abbreviations: MDS Minimum Dataset, ADL Activities of Daily Living, GMPI Geriatric Multidimensional Pain and Illness Inventory, GDS-15 Geriatric Depression Scale-15 short version, PRADLI Psychosocial Resistance to Activities of Daily Living Index, GLDS Geriatric Level of Dysfunction Scale, PGC-PIS Philadelphia Geriatric Centre Pain Intensity Scale, CSDD Cornell Scale for Depression in Dementia, CMAI Cohen-Mansfield Agitation Inventory, SMOI Structured Meal Observational Instrument, HAM-D Hamilton Rating Scale for Depression, NPI Neuropsychiatric Inventory, PAINAD Pain Assessment in Advanced Dementia, STAI State-Trait Anxiety Inventory, AAS Adjusted Activity Scale, PPQ Proxy Pain Questionnaire, CNA Certified Nursing Assistant, RMBPC-NH Revised Memory and Behaviour Problems Checklist-Nursing Home, BEHAVE-AD Behavioural Pathology in Alzheimer's disease, PSMS Physical Self Maintenance Scale, VDS Verbal Descriptor Scale, KATZ Index of Independence in Activities of Daily Living, IADL Instrumental Activities of Daily Living, OARS/IADL Older Americans Recourses and Services/Instrumental Activities of Daily Living, VRS Verbal Rating Scale, DQoI Dementia Quality of life, APAS Albert Patient activity Scale, DS-DAT Discomfort Scale - Dementia of Alzheimer Type, PAS Pittsburgh Agitation Scale

Table 5 Correlates of pain and neuropsychiatric symptoms

Correlates of pain and specified NPS					
First author	N	Pain: prevalence	Neuropsychiatric symptoms: prevalence	Correlates of pain with NPS	Quality of study
Ahn 2013 ³⁶	56577	Not reported	Wandering 9 %	AOR 0.77 (95 % CI: 0.73-0.81) with wandering Subsample without psychotropic medication AOR 0.72 (95 % CI: 0.63-0.83) with wandering (Adjusted for cognition, ADL, sociodemographics)	10
Kunik 2005 ³⁴	99	Pain mean 2.4 (SD 1.2)	Delusions/hallucinations mean 0.35 (SD 0.48)	r = 0.15 (p > 0.05) with psychosis	8.5
Leong 2007 ³⁵	225	Pain 44 %, chronic pain 34 %	Anxiety 48 %	SOR 1.8 (95 % CI: 1.0-3.0) with anxiety	8.5
Norton 2010 ⁴²	161	Not reported	BEHAVE-AD mean 6.4 (SD 29.2) RMBPC-NH mean 1.45 (SD 0.64)	r = 0.15 (p = 0.08) for pain intensity and emotional behaviour problems r = 0.05 (p = 0.58) for pain intensity and resistiveness to care	9
Torvik 2010 ⁵²	106	Current pain in total group 55 %, in cognitive impaired group 52 %	Negative affect index (DQoL) mean 2.0 (SD 0.75), positive affect/humour index (DQoL) mean 3.4 (SD 0.9)	p < 0.01 for current pain and negative affect p = 0.11 for current pain and with positive affect/humour	6.5
Tosato 2012 ³	2822	Any pain 19 % (moderate/severe/excruciating pain 13 %)	Behavioural symptoms 37 % Psychiatric symptoms 21 %	AOR = 0.74 (95 % CI: 0.55-1.0) with wandering AOR = 1.4 (95 % CI: 1.08-1.8) with resistance to care AOR 1.5 (95 % CI: 1.07-2.03) with delusions AOR 1.06 (95 % CI: 0.80-1.41) with verbal abuse AOR 1.08 (95 % CI: 0.75-1.55) with physical abuse (Adjusted for age, gender, country, cognitive impairment, number of diseases, ischemic heart disease, stroke, falls, communication problems, and a flare-up of a chronic or recurrent condition)	11.5
Volicer 2009 ³⁷	929	Daily pain 29 %, less than daily pain 19 %	Verbally abusive not easily altered 2 %, physically abusive not easily altered 12 % Delusions 8 % Hallucinations 9 %	r = 0.07 (p = 0.03) for pain frequency and verbal abuse AOR = 0.9 (p = 0.53) with resisting care AOR = 0.7 (p = 1.2) with verbal abuse AOR = 0.7 (p = 0.16) with physical abuse (Both multivariate models among others controlled for resisting care)	11
Zieber 2005 ³⁸	58	Not reported	Not reported	r = 0.46 (p < 0.01) for DS-DAT scores and resisting care r = 0.42 (p < 0.01) for DS-DAT scores and aberrant vocalization Pain rating by palliative care nurse consultants: r = 0.51 (p < 0.01) with resisting care r = 0.40 (p < 0.01) with aberrant vocalizations Pain rating by facility nurse: r = 0.48 (p < 0.01) with resisting care r = 0.065 (p < 0.63) with aberrant vocalizations	8

Table 5 Correlates of pain and neuropsychiatric symptoms (Continued)

Correlates of pain and unspecified NPS					
First author	N	Pain: prevalence	Neuropsychiatric symptoms: prevalence	Correlates of pain with unspecified NPS	Quality of study
Black 2006 ³⁹	123	Pain 63 %	Psychiatric disorders or behaviour problems 85 %, behaviour problems 67 %	SOR 1.9 (95 % CI: 0.7-5.3) with psychiatric/behaviour problems SOR 1.2 (95 % CI: 0.5-2.5) with behaviour problems	6.5
Brummel-Smith 2002 ⁴⁰	104 (excluding those unable to self-report pain)	Moderate-severe pain 60 % No-mild pain 40 % 50 subject unable to answer	≥1 disruptive behaviours (wandering, verbal disruption, physical aggression, regressive behaviour, hallucinations) 70 % in dementia sample n = 154	SOR 1.8 (95 % CI: 0.8-4.0) with ≥ 1 disruptive behaviour	7
Cipher 2004 ⁴	234	Persistent pain 72 %	Dysfunctional behaviours mean 4.4 (SD 0.76)	r = 0.22 (p < 0.05) with dysfunctional behaviours	7.5
Cipher 2006 ⁴¹	277	Acute pain 29 % Chronic pain 59 %	-	r = 0.18 (p < 0.05) with GLDS mean behavioural intensity	7.5
Norton 2010 ⁴²	161	Not reported	BEHAVE-AD mean 61.4 (SD 29.2) RMBPC-NH mean 1.45 (SD 0.64)	r = 0.18 (p = 0.03) for pain intensity and disruptive behaviour problems r = 0.05 (p = 0.53) for pain intensity and global need driven behaviours	9
Tosato 2012 ³	2822	Any pain 19 % (moderate/severe/excruciating pain 13 %)	Behavioural symptoms 37 % Psychiatric symptoms 21 %	AOR = 1.4 (95 % CI: 1.04-1.8) with socially inappropriate behaviour (Adjusted for age, gender, country, cognitive impairment, number of diseases, ischemic heart disease, stroke, falls, communication problems, and a flare-up of a chronic or recurrent condition)	11.5
Williams 2005 ³⁹	331	Pain 21 %, in nh 23 %, in rc/al 20 % (self-report for subgroup mmse > 10 was higher: 39 % and 25 %)	Behavioural symptoms 58 %	OR = 1.1 (95 % CI: 0.49-2.29) and AOR = 1.2 (95 % CI: 0.57-2.36) with behavioural symptoms (Adjusted for: sex, race, age, cognitive status, number of 10 comorbidities, impairments of 7 activities of daily living)	10

Abbreviations: AOR Adjusted Odds Ratio, ADL Activities of Daily Living, SD Standard Deviation, r correlation coefficient, SOR Self-Calculated Odds Ratio, BEHAVE-AD Behavioural Pathology in Alzheimer's disease, RMBPC-NH Revised Memory and Behaviour Problems Checklist-Nursing Home, DQoL Dementia Quality of life, DS-DAT Discomfort Scale - Dementia of Alzheimer Type, GLDS Geriatric Level of Dysfunction Scale, rc/al residential care/assisted living, MMSE Mini Mental State Examination, OR Odds Ratio

Table 6 Correlates of pain with physical function

Correlates of pain and ADL or IADL					
First author	N	Pain: prevalence	Physical function: prevalence	Correlates of pain with ADL or IADL	Quality of study
Brummel-Smith 2002 ³⁶	104 (excluding those unable to self-report pain)	Moderate-severe pain 60 %, no-mild pain 40 % (50 subject unable to answer)	≥1 ADL limitations 92 % in dementia sample (n = 154)	SOR 1.9 (95 % CI: 0.6-6.0) with ≥ 1 ADL limitation	7
Cipher 2004 ⁴	234	Persistent pain 72 %	ADL independency mean 0.09 (SD 0.99)	Correlations with GMPI 'pain and suffering' r = -0.04 (α > 0.05) with ADL independency	7.5
Shega 2005 ⁴⁴	115	Any current pain self-report 32 %, caregiver report 53 %	KATZ mean 8.5 (SD 2.7), IADL mean 15.3 (SD 3.9)	For self-report pain No association ADL and IADL (p > 0.05) For caregiver pain report No association with ADL or IADL (p > 0.05)	9.5
Shega 2010 ⁴⁵	5549	Moderate or greater pain: 35.8 %	Any IADL impairment: 66.5 %	OR = 1.74 (95 % CI: 1.15-2.62) with any iADL impairment (Adjusted for demographics)	9
Torvik 2010 ⁴⁸	106	Current pain in total group 55 %, in cognitive impaired group 52 %	Highly or moderate ADL dependent 36 %	p = 0.20 for current pain and ADL SOR = 0.5 (95 % CI: 0.2-1.2) for current pain and ADL high/medium v.s. low	6.5
Tosato 2012 ³	2822	Any pain 19 % (moderate/severe/excruciating pain 13 %)	No disability 8 %, assistance required 43 %, dependent 49 %	SOR 1.0 (95 % CI: 0.9-1.2) with ADL-dependent SOR 0.9 (95 % CI: 0.75-1.09) with ADL assistance required (Adjusted for age, gender, country, cognitive impairment, number of diseases, ischemic heart disease, stroke, falls, communication problems, and a flare-up of a chronic or recurrent condition)	11.5

Table 6 Correlates of pain with physical function (Continued)

Correlates of pain and other functional impairments					
First author	N	Pain: prevalence	Physical function: prevalence	Correlates of pain with ADL or IADL	Quality of study
Black 2006 ³⁹	123	Pain 63 %	Nutrition/hydration problems total sample 85 %	SOR 1.9 (95 % CI: 0.7-5.3) with nutrition/hydration problems	6.5
Brummel-Smith 2002 ⁴⁰	104 (excluding those unable to self-report pain)	Moderate-severe pain 60 %, no-mild pain 40 % (50 subject unable to answer)	≥1 ADL limitations 92 % in dementia sample (n = 154)	SOR 1.6 (95 % CI: 0.6-4.2) with bladder incontinence	7
D'Astolfo 2006 ⁴⁴	140	Pain 64 % (musculoskeletal pain 40 %)	Use of wheel chair 60 % Requires assistance 34 %	SOR 1.5 (95 % CI: 0.7-3.0) with use of wheel chair or bedridden SOR 1.0 (95 % CI: 0.5-2.0) with requires assistance (Analyses in sample of no dementia-severe dementia)	7
Lin 2011 ⁴⁶	112	Observed pain 37 % (PAINAD >=2)	Being restrained 46 %; observed care activities: bathing 43 %, assisted transfer 31 %, self-transfer 26 %	OR = 5.4 (95 % CI: 2.3-12.5) and AOR = 3.0 (95 % CI: 1.0-8.7) with being restrained OR = 23.4 (95 % CI: 3.0-188) and AOR = 19.2 (95 % CI: 2.3-162) with bathing OR = 29.7 (95 % CI: 3.6-242) and AOR = 11.3 (95 % CI: 1.2-102) with assisted transfer, both compared to self-transfer (Adjusted for gender, age, wound, restraint, tube present in body, recent fall, severity of dementia and type of activity)	12
Williams 2005 ⁴³	331	Pain 21 %, in nh 23 %, in rc/al 20 % (self-report for subgroup MMSE > 10 was higher: 39 % and 25 %)	Low activity 47 %, immobile 12 % Low food intake 53 % Low fluid intake 51 %	OR = 0.65 (95 % CI: 0.38-1.11) and AOR = 0.64 (95 % CI: 0.37-1.10) with low activity OR = 1.1 (95 % CI: 0.49-2.29) and AOR = 0.8 (95 % CI: 0.37-1.69) with immobility OR = 1.18 (95 % CI: 0.64-2.17) and AOR = 1.03 (95 % CI: 0.56-1.87) with low food intake OR = 1.20 (95 % CI: 0.67-2.15) and AOR 1.14 (95 % CI: 0.66-1.99) with low fluid intake (Adjusted for: sex, race, age, cognitive status, number of 10 comorbidities, impairments of 7 activities of daily living)	10

Abbreviations: SOR Self-Calculated Odds Ratio, ADL Activities of Daily Living, SD Standard Deviation, *r* correlation coefficient, GMPI Geriatric Multidimensional Pain and Illness Inventory, PAINAD Pain Assessment in Advanced Dementia, OR Odds Ratio, AOR Adjusted Odds Ratio, KATZ Index of Independence in Activities of Daily Living, IADL Instrumental Activities of Daily Living, *nh* nursing home, *rc/al* residential care/assisted living, MMSE Mini Mental State Examination

Author details

¹Department of Public Health and Primary Care, Leiden University Medical Centre, Hippocratespad 21 Post zone V0-P, PO Box 9600, Leiden, RC 2300, The Netherlands. ²Department of General Practice & Elderly Care Medicine, VU University Medical Centre Amsterdam, van der Boechorststraat 7, Amsterdam, BT 1081, The Netherlands. ³Malteser Hospital Bonn/Rhein-Sieg, Centre of Geriatric Medicine, Academic Hospital University of Bonn, Von-Hompesch-Straße 1, Bonn 53123, Germany. ⁴Department of Public Health and Primary Care, Centre for Elderly and Nursing Home Medicine, University of Bergen, Bergen, Norway. ⁵Stavanger University Hospital, Bergen, Norway.

Received: 8 July 2015 Accepted: 8 July 2015

Published online: 09 September 2015

**Submit your next manuscript to BioMed Central
and take full advantage of:**

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at
www.biomedcentral.com/submit

