(Under)treatment of pain in dementia

Plooij, B.

2012

document version
Publisher's PDF, also known as Version of record

Chapter 7

The effect of structured daily pain assessment and treatment on cognition of patients with dementia: a longitudinal implementation study

Plooij, B., Vuijk, P.J., Swaab, D.F., Scherder, E.J.A.

Abstract

Dementia patients are at increased risk for undertreatment of pain, due to communicative disorders. Pain influences cognitive functioning negatively in chronic pain patients, and may increase existing cognitive deficits. In turn, treating pain may improve cognition. The aim of the present study is to reduce undertreatment of pain in dementia by implementing pain assessment in the routine daily care, and to examine its effect on pain medication prescription and cognitive functioning.

Initially 13 wards (187 residents) participated. In 9 wards (136 residents) pain assessment (PACSLAC-D) was implemented as part of routine daily care. Four wards (51 residents) formed the control group. Cognitive functioning was assessed with the Mini Mental State Examination (MMSE), and an extensive neuropsychological battery. Pain medication was divided into three categories, i.e. paracetamol, NSAID, and opioids. The variables were dichotomous, i.e. prescribed at least once during the previous 12 weeks, or no prescription.

Significant time*group interaction effects were present for paracetamol, opioids, MMSE, and digit span backward. Changes in pain medication prescription show an active pain treatment policy in the intervention group, whereas no changes were present in controls. Additionally, MMSE and digit span backward decreased significantly less over a period of nine months in the intervention group, compared to the control group.

Structured pain assessment as part of routine daily care of dementia patients has a positive effect on pain treatment and cognitive functioning. The fact that the nurses executed the intervention suggests that the intervention can be successfully extended to other nursing homes.

Introduction

Age is the major risk factor for dementia (Lindsay et al., 2002; Skoog, 2004), which, in turn, increases the likelihood to be admitted to a nursing home (Eeker et al., 2002). Additionally, aging is associated with increased prevalence of chronic painful conditions, e.g. chronic back or neck pain, arthritis, and joint pain (Tsang et al., 2008). In view of this, it is alarming that people with dementia living in nursing homes are at considerable risk for undertreatment of pain (Scherder et al., 2005; Achterberg et al., 2007; Husebo et al., 2008; Plooij et al., 2012). The main reason for undertreatment of pain is underdetection of pain, which is mainly caused by a decreased ability to communicate about pain due to decreased cognitive functioning (Zwakhalen et al., 2006a). Also the ability to use self-report pain scales is diminished in dementia patients, and this ability decreases with increasing cognitive impairment (Kunz et al., 2009).

Undertreatment of pain may in turn negatively influence cognitive functioning. More specifically, in chronic pain patients a decrease in the following cognitive functions has been observed: episodic memory (Oosterman et al., 2011; Weiner et al., 2006), recognition memory (Kuhajda et al., 2002), working memory (Oosterman et al., 2011), attention (Kuhajda et al., 2002), mental flexibility (Karp et al., 2006), and emotional decision-making (Apkarian et al., 2004). Additionally, it has been stated that pain increases existing cognitive deficits (Frampton et al., 2003). However, these findings are equivocal, i.e. two studies did not find memory impairment in chronic pain patients (Apkarian et al., 2004; Karp et al., 2006), and one study failed to show changes in executive functioning (Apkarian et al., 2004). Although the studies on the influence of chronic pain on cognition are not completely unambiguous, it seems fair to conclude that pain does impair cognition to some extend. In reverse, it has also been shown that treating pain in chronic pain patients without dementia may improve cognitive functioning (Lorenz and Bromm, 1997; Tassain et al., 2003).

The aim of the present study was to reduce undertreatment of pain in psychogeriatric nursing homes by implementing a pain observation scale in the routine daily care, and to examine its effect on pain medication

prescription and the cognitive functioning of patients with dementia. The pain observation scale used in this study is the Dutch version of the Pain Assessment Checklist for Seniors with Limited Abilities to Communicate (PACSLAC-D; Zwakhalen et al., 2007). At this moment, the PACSLAC is one of the best methods to assess pain in older people with dementia (Aubin et al., 2007), and nurses qualified it as the most user-friendly pain scale (Zwakhalen et al., 2006b). Additionally, implementation of the PACSLAC has been proven successful in increasing analgesic medication in dementia patients, and reducing the workload of their nurses (Fuchs-Lacelle et al., 2008). It is expected that due to the structured pain assessment pain will be detected earlier, resulting in a more effective pain treatment, and stabilizing or even improving cognitive functioning in demented nursing home residents.

Method

Subjects

Subjects

Initially, a total of 187 people, living in 13 psychogeriatric nursing home wards participated in this study. The intervention took place in 9 wards, accommodating 136 residents (mean age 84.98 ± 7.42 years; 94 women), i.e. a structured pain assessment was implemented as part of routine daily care. The other 4 wards, accommodating 51 residents (84.40 ± 7.23 years; 41 women), did not change their daily care, and formed the control group. Thirty-one participants were excluded because they could not talk or were otherwise unable to answer questions (18 participants from the intervention group; 13 participants from the control group), two participants were excluded because of hearing problems (intervention group: 1; control group: 1), and two participants were excluded because they did not speak Dutch (intervention group: 1; control group: 1). In addition, 8 residents refused to participate (intervention group: 6; control group 2), leaving 108 participants in the intervention group, and 34 participants in the control group at the first measuring point. Because the task difficulty was different for the various tasks that were used as outcome measures, the number of participants per task differs. Participant

flow over the measurement points for the different outcome measures is shown in table 1. Reasons for further dropout during the intervention were 1) death, 2) disease progression, causing participants to be unable to talk or answer question, 3) moving to other care facilities. Participant characteristics at baseline are shown in table 2.

Table 1 Number of subjects per measurement occasion, separate for control group and intervention group for each of the 7 cognitive outcome variables and 3 medication outcome variables.

Variable		Measurement baseline	3 m	6 m	9 m	Total number of observations
MMSE	Intervention	108	66	49	34	353
	Control	34	27	23	12	
8 WT immediate recall	Intervention	63	36	33	27	215
	Control	24	14	12	6	
DS forward	Intervention	68	43	38	30	244
	Control	21	17	16	11	
DS backward	Intervention	65	42	36	26	231
	Control	21	16	16	9	
Fluency	Intervention	60	37	32	29	219
	Control	22	15	16	8	
Incomplete figures	Intervention	59	35	33	28	214
	Control	23	15	15	6	
		Measurement				Total number of
		baseline	3 m	6 m	N.A.	observations
Paracetamol	Intervention	81	47	44	-	257
	Control	31	27	27	-	
NSAID	Intervention	81	47	44	-	257
	Control	31	27	27	-	
Opioid	Intervention	81	47	44	-	257
	Control	31	27	27	-	

m = months; NSAID = non-steroidal anti-inflammatory drugs.

Confounding Factors

In order to identify possible confounding factors the groups were compared with each other for differences in age, male-female distribution, education, and the presence of comorbid conditions.

Level of education was divided into two categories: 1) lower education (i.e. elementary school not finished, elementary school finished, and lower secondary education); 2) higher education (i.e. medium and higher secondary education, and higher vocational training for 18+/university).

Table 2 Participant characteristics at baseline.

	Intervention group (n=108)	Control group (n=34)	Statistics		
			t	df	p
Age [y; mean ± sd (range)]	84.48 ± 6.98 (61-79)	85.45 ± 6.52 (69-98)	-0.71	134	0.48
			χ^2	df	p
Sex			1.73	1	0.19
Male [n(%)]	35 (32.4)	7 (20.6)			
Female [n(%)]	73 (67.6)	27 (79.4)			
Education			0.34	1	0.56
Low [n]	20	6			
High [n]	21	9			
Unknown [n]	67	19			
Diagnosis			3.34	3	0.34
AD [n(%)]	42 (38.9)	9 (26.5)			
VaD [n(%)]	10 (9.3)	2 (5.9)			
Mixed [n(%)]	9 (8.3)	2 (5.9)			
Other [n(%)]	32 (29.6)	15 (44.1)			
Unknown [n(%)]	15 (13.9)	6 (17.6)			
			Mann Whitney U		p
MMSE [mean ± sd (range)]*	10.04 ± 7.19 (0-25)	9.82 ± 6.55 (0-27)	1,815.5		0.92
8WT direct recall [mean ± sd (range)]*	11.15 ± 6.98 (0-27)	10.08 ± 6.67 (0-21)	680.0		0.54
Digit Span Forward [mean ± sd (range)]*	8.79 ± 3.34 (1-18)	8.52 ± 4.19 (0-19)	686.0		0.86
Digit Span Backward [mean ± sd (range)]*	3.83 ± 2.56 (0-9)	3.95 ± 2.67 (0-11)	638.5		0.73
Fluency [mean ± sd (range)]*	8.76 ± 6.31 (0-33)	6.77 ± 5.86 (0-22)	503.0		0.12
Incomplete figures [mean ± sd (range)]*	3.79 ± 2.29 (0-10)	3.26 ± 2.70 (0-10)	568.5		0.30

8WT = 8 word test; AD = Alzheimer's disease; Mixed = mixed dementia (AD + VaD); MMSE = mini mental state examination; n = number of participants; sd = standard deviation; VaD = vascular dementia; y = years; *= The number of participants varies per test. See table 2 for the number of participants per test.

The presence of comorbid conditions is extracted from the medical status and categorized based on the Dutch translation of the Long-Term Care Facility Resident Assessment Instrument (RAI), section I. This section (disease diagnoses) includes the following categories: 1) endocrine/metabolic/nutritional, i.e. diabetes mellitus, hyperthyroidism

and hypothyroidism, 2) heart/circulation, i.e. arteriosclerotic heart disease, cardiac dysrhythmia, congestive heart failure, deep vein thrombosis, hypertension, hypotension, peripheral vascular disease and other cardiovascular disease, 3) musculoskeletal, i.e. arthritis, hip fracture, missing limb (e.g. amputation), osteoporosis and pathological bone fracture, 4) neurological, i.e. Alzheimer's disease, aphasia, cerebral palsy, cerebrovascular accident, dementia other than Alzheimer's disease, hemiplegic/hemi paresis, paraplegia, multiple sclerosis, Parkinson's disease, seizure disorder, transient ischemia attack, traumatic brain injury and quadriplegia, 5) sensory, i.e. cataracts, diabetic retinopathy, glaucoma and macular degeneration, 6) psychiatric/mood, i.e. anxiety disorder, depression, manic depression (bipolar disorder) and schizophrenia, 7) pulmonary, i.e. asthma and emphysema/chronic obstructive pulmonary disease, 8) other, i.e. allergies, anaemia, cancer and renal failure.

No differences were present between the two groups on any of the possible confounding factors.

Materials and Procedure

Materials

Intervention

The Pain Assessment Checklist for Seniors with Limited Abilities to Communicate – Dutch version (PACSLAC-D; Zwakhalen et al., 2007) was used as pain assessment tool in the intervention group. The PACSLAC-D is an abbreviated version of the original PACSLAC (Fuchs-Lacelle & Hadjistavropoulos, 2004). This checklist is developed for pain assessment in dementia patients. The PACSLAC-D consists of 24 items describing behaviour that may indicate pain, e.g. smirking, verbal aggression, or being restless. The 24 items are grouped into three categories, i.e. facial expressions, resistance/defence, and social-emotional/mood. The maximum score is 24 (one point for each item). A score of 4 or more is considered indicative of pain.

Cognitive Functioning

An extensive neuropsychological test battery was available to test cognitive functioning. For each participant it was individually determined which tests were administered, based on his or her performance.

The Mini Mental State Examination (MMSE; Folstein et al., 1975) was used to assess global cognitive functioning. The MMSE evaluates orientation in time and place, registration, recall, attention and calculation, language and praxis, and visuoconstructive abilities (maximum score: 30).

The Eight Words Test, a subtest of the Amsterdam Dementia Screening Test (Lindeboom & Jonker, 1989), was applied to assess verbal episodic memory. In this test, a list of 8 words is read aloud by the examiner. The Immediate Recall subtest consists of the total number of correct words named after 5 trials (maximum score: 40). The Delayed Recall subtest is composed of the total number of words that are correctly reproduced after an interval of approximately 10 minutes; this subtest measures particularly active retrieval from memory store (maximum score: 8). In the Recognition subtest, the participant had to recognize the original 8 words from a set of 16 words. The recognition score is the total of correct responses (maximum score: 16).

Faces Recognition of the Rivermead Behavioural Memory Test (Wilson et al., 1987) is a visual, nonverbal long-term episodic memory test. The test consists of a set of 10 pictures of different faces (extended version). Each card is presented in a fixed order during 4 seconds. After an interval of 5 minutes, subjects had to select the original 10 faces from a set of 20 cards. The score is the number of correct responses (maximum score: 20).

Picture Recognition of the Rivermead Behavioural Memory Test (Wilson et al., 1987) measures the visual-verbal long-term episodic memory. The test consists of 20 cards (extended version) showing line drawings of various objects; each card is presented for 4 seconds in a fixed order. The subjects were asked to name the object on the cards. After a 5-minute interval, a set of 40 cards was presented and the subjects had to select the original 20 cards. The score is the number of correct responses (maximum

score: 40).

In *Category Fluency*, a subtest from the Dutch Groninger Intelligence Test (Luteijn & Van der Ploeg, 1983), subjects have to name as many words as possible from a specified category in one minute. There are two different categories: animals and professions. The score is the number of correctly produced words in both categories.

Digit Span Forward is a subtest of the Wechsler Memory Scale (WMS; Wechsler, 1945). This subtest measures short-term memory and attention. In this condition, the subjects are asked to repeat a sequence of digits (range 2–8) in the same order as read aloud by the examiner (maximum score: 21).

Digit Span Backward is another subtest of the Wechsler Memory Scale (Wechsler, 1945). This subtest measures working memory. In this condition, the subjects are asked to repeat a sequence of digits (range 2–8) that are read aloud by the examiner in the reverse order (maximum score: 21).

Visual Memory Span Forward is a subtest of the Wechsler Memory Scale – Revised (WMS-R; Wechsler, 1987) and is applied to measure visual attention. In this condition, the subjects are asked to tap sequences of printed squares (range 2–8) in the same order as tapped by the examiner (maximum score: 14).

Visual Memory Span Backward is another subtest of the Wechsler Memory Scale – Revised (Wechsler, 1987) and measures visual working memory. In this condition, the subjects are asked to tap sequences of printed squares (range 2–7) in the reverse order compared to the order tapped by the examiner (maximum score: 12).

The Rule Shift Card Test is a subtest of the Behavioural Assessment of the Dysexecutive Syndrome (BADS; Wilson et al., 2003). The aim of this subtest is to assess mental flexibility. Participants have to respond to stimuli (red or black playing cards) according to one of two rules that are presented consecutively. Performance is scored according to how

successful the respondent shifts from applying the first to the second rule. The score is the number of correct responses to the second rule (maximum score: 20).

The Key Search Test is also a subtest of the BADS (Wilson et al., 2003), and measures planning and problem solving abilities. Participants have to imagine that they lost their keys on a large field represented by a square on a piece of paper. Subsequently they are asked to draw a line, representing the route they would walk to find their keys. The score is based on the efficiency of the search strategy (maximum score: 16).

The Stroop Color-Word Test (Stroop, 1935) consists of three subtests. The first subtest is the *Word Card* and consists of a card with 100 colour words (red, green, blue, yellow) printed on it in black ink. The participants have to read aloud as many words as possible in 45 seconds. The second subtest is the *Color Card* with 100 coloured squares printed on it (red, green blue, yellow). The participants have to name as many colours as possible in 45 seconds. These two subtests measure attention. The third subtest, the *Color-Word Card,* has the names of the four colours on it, printed in a different ink colour. In this subtest the participants need to name the colour of the ink, thus suppressing reading the word, again as many as possible in 45 seconds. This subtest measures response inhibition.

Digit Symbol Substitution Test is a subtest of the Wechsler Adult Intelligence Scale (WAIS; Wechsler, 1955). The test consists of a code table at the top of the sheet, showing a row of 9 different digits, with below every digit a unique symbol. Below this code table, rows of boxes with digits are drawn, with empty boxes directly below each box. The participants need to use the code table to draw as many correct symbols as possible in the empty boxes in two minutes.

Incomplete Figures is also a subtest of the Groninger Intelligence Test (GIT; Luteijn & Van der Ploeg, 1983). The test consists of 22 incomplete figures that can only be named by using one's closure capacity. The degree of vagueness of the incomplete figures increases during the test. The score is the number of correct responses (maximum score: 20).

Pain Medication

Pain medication was divided into three categories, i.e. (1) paracetamol (acetaminophen), (2) non-steroidal anti-inflammatory drugs (NSAID's, e.g. acetylsalicylic acid, diclofenac, ibuprofen; low doses of acetylsalicylic acid prescribed for prophylaxis of cardiovascular events are not included), and (3) opioids (e.g. tramadol, fentanyl). Because a limited number of participants had any pain medication prescribed during the 12 weeks previous to the first three measurement occasion, i.e. the week before the start of the intervention, and subsequently after 3, and 6 months, it was decided to form three dichotomous variables, i.e. any pain medication prescribed at least once during the 12 weeks previous to the measurement occasion, or no pain medication prescribed.

Procedures

In the wards that formed the intervention group, the PACSLAC-D (Zwakhalen et al., 2007) was implemented as part of daily care. The nurses were extensively trained in observation methods, and in scoring the observation scale by one of the authors (BP). The nurses were instructed to observe the patients two times every day, once during morning care (helping the patient out of bed, washing and dressing the patient), and once during the afternoon, when there was no interaction with the patient. At least once every week the scores of the PACSLAC-D were discussed with the nursing home physician, who, if necessary, changes or starts pain treatment. This way the PACSLAC-D functions as an evaluation tool. In case of an indication for pain on the PACSLAC-D, and no existing pain medication, pain treatment (pharmacological or non-pharmacological) was started. In case of existing pain medication, but no indication for pain on the PACSLAC-D, pain medication was reduced or terminated.

To evaluate the effect of the structured pain assessment and hence improved pain treatment on the cognitive functioning of the participants, the neuropsychological assessment was administered in the week before the start of the intervention, and subsequently after 3, 6, and 9 months.

Informed Consent

Proxies of all participants were extensively informed about the aim and procedures of this study, both verbally and by means of an information letter, and provided written informed consent. A local medical ethical committee approved the study.

Data analysis

Possible age-differences between the intervention group and the control group are examined by means of an independent sample t-test. Pearson Chi squared tests are used to examine the groups for possible differences in sex distribution, education level, and presence of comorbidities. A p-value of <0.05 was considered significant. Because of the high number of registered comorbidities, a Bonferroni correction is applied to control for multiple comparisons, resulting in a p-value of < 0.001 (0.05/44) to be significant.

The multilevel modelling program MLwiN (Rasbash, Steele, Browne, & Goldstein, 2009) was used to evaluate the effect of the intervention on the cognitive outcome measures. For a reliable analysis a minimum of 5 observations per group per measurement occasion was chosen. Because a vast part of the neuropsychological tests turned out to be to difficult for our participants, combined with the high dropout rate, only 6 neuropsychological tasks could be evaluated, i.e. MMSE, Immediate Recall subtest of the 8 Word test, Digit Span Forward, Digit Span Backward, Fluency, and Incomplete Figures. Because information about pain medication for the last measurement was lacking for 4 participating wards, pain medication prescription could only be analysed over three measurement occasions.

For each of the 6 cognitive outcome measures a repeated measures model (or longitudinal growth model) was fitted using multilevel modelling. Multilevel modelling is an extension of regular regression analysis, which is appropriate when data are hierarchically structured (in the current study multiple measurements over time within a person). A major advantage of this statistical technique is that it does not require the data to be balanced

(i.e. the number of measurement occasion may differ per person) and it assumes that missing data are random, so even when subjects are examined on only one occasion they still can be included in the model. Multilevel analysis allows for the estimation of individual longitudinal growth curves as well as growth curves for predefined groups (Snijders & Bosker, 1999).

Six different growth models for MMSE, Immediate Recall subtest of the 8 Word test, Digit Span Forward, Digit Span Backward, Fluency, and Incomplete Figures are being examined with subject as a level 2 variable and measurement occasion a level 1 variable. The explanatory variables are time of measurement with four levels (baseline measurement occasion is the reference category), group (intervention versus control), and to examine a treatment effect an interaction between time of measurement and group is examined. The model including the interaction between time of measurement and group is being compared with the model without the interaction and the χ^2 and p-values of the deviance test are presented. Non-significant interaction effects are dropped from the model. A *p*-value of < 0.05 is considered significant.

For evaluation of the prescription of pain medication, every pain medication variable was dichotomized because the distribution was very skewed. This resulted in three binary dependant pain variables. Generalized Estimated Equations (GEE) was used to fit three repeated measures logistic regression models, one for each type of medication (i.e. paracetamol, NSAID, and opioids). Measurement occasion with three levels (baseline measurement occasion is the reference category), group (intervention versus control), as well as an interaction between measurement occasion and group are included in the model as independent factors. A significant interaction effect is an indication of a treatment effect. In order to specify possible interaction effect the prescription over time per group was examined. These analyses are performed using PASW 20. A *p*-value of < 0.05 was considered significant.

Results

Cognitive functioning

Table 3 shows the repeated measure models for the six cognitive outcome variables. The repeated measurement models examining the change in MMSE performance show a significant interaction between group and time, indicating that the control group deteriorates significantly more across time than the intervention group. The separate interactions for the three time intervals show that this effect is due to significant interactions for the period 3 months-6 months, and the period 6 months-9 months. The interaction for the period 0 months-3 months is not significant (table 3, figure 1).

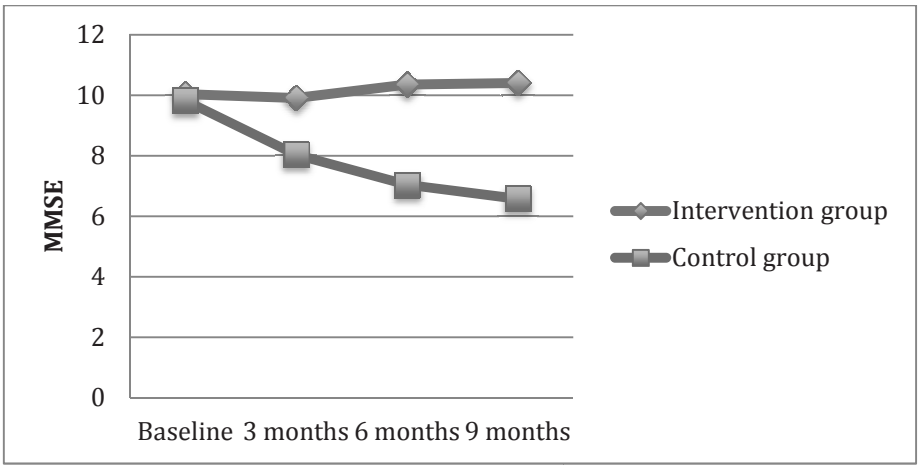

Figure 1. Change in MMSE-scores during the time of the intervention for the intervention group and the control group.

The repeated measurement models examining the change in Digit Span Backward performance also show a significant interaction between group and time indicating that the control group deteriorates significantly more across time than the intervention group. The separate interactions for the three time intervals show that this effect is due to a significant interaction for the period 6 months-9 months. The interaction for the first two periods is not significant (table 3, figure 2).

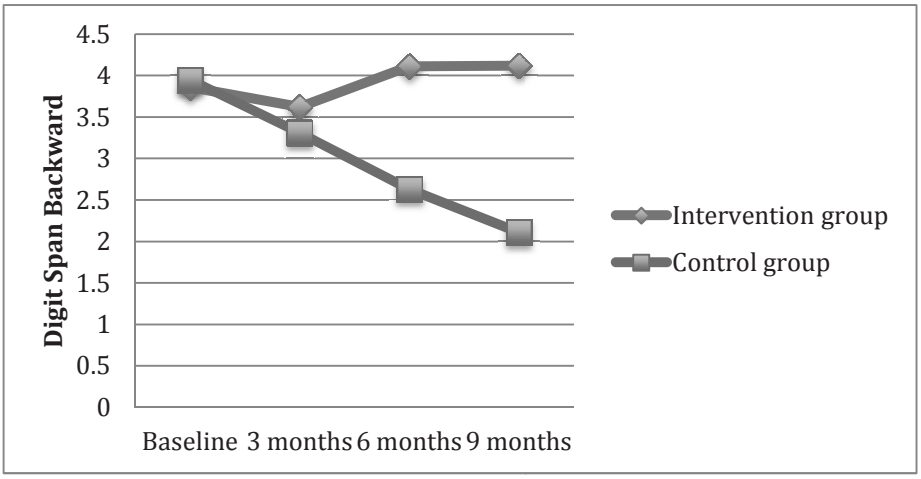

Figure 2. Change in Digit Span Backward-scores during the time of the intervention for the intervention group and the control group.

The repeated measurement models examining the change in performance on the other cognitive tests, i.e. 8 Word Test Immediate Recall, Digit Span Forward, Fluency Professions, and Incomplete Figures, show no significant interaction between group and time (table 3).

Pain medication

Paracetamol

The repeated measurement models examining the change in number of participants that have paracetamol prescribed show a significant interaction between group and time. Post-hoc analysis of the prescription over time per group shows no significant changes in the control group. In the intervention group a significant main effect for time is found. The proportion of participants in the intervention group that get paracetamol prescribed at 3 months is significantly bigger compared to baseline. The proportion of participants that get paracetamol prescribed at 6 months does not differ significantly compared to baseline. These findings imply that the number of participants that have paracetamol prescribed increases significantly in the period from baseline to 3 months, and subsequently decreases in the period 3 months – 6 months to a level that is comparable to baseline, suggesting an active pain treatment policy in the intervention group (table 4).

Table 3. Repeated measures models for the seven cognitive outcome variables.

	MMSE			**8 WT immediate recall**			**DS forward**		
Fixed effects	**Coefficient**	**SE**	**p-value**	**Coefficient**	**SE**	**p-value**	**Coefficient**	**SE**	**p-value**
Constant	9.55	1.15	<0.001	9.52	1.47	<0.001	8.52	0.73	<0.001
Time 1 (reference)	-	-	-	-	-	-	-	-	-
Time 2	-1.72	0.78	0.03	-0.76	1.58	0.63	-1.05	1.09	0.33
Time 3	-3.23	0.82	<0.001	-3.13	1.66	0.06	-2.19	1.13	0.05
Time 4	-3.84	1.05	<0.001	-2.52	2.14	0.24	-1.07	1.24	0.39
Group (Int. vs. Con.)	0.46	1.33	0.73	1.54	1.73	0.37	0.32	0.83	0.70
Group*Time 2	1.14	0.91	0.22	-	-	-	-	-	-
Group*Time 3	2.50	0.98	0.01	-	-	-	-	-	-
Group*Time 4	2.97	1.22	0.02	-	-	-	-	-	-
Random effects									
Level 2	39.09	5.07		36.65	6.81		7.60	1.35	
Level 1	7.98	0.79		18.18	2.37		3.91	0.47	
Deviance	2,089.43			1,389.86			1,192.75		
	χ^2	**df**	**p**	χ^2	**df**	**p**	χ^2	**df**	**p**
Interaction Group*Time	8.90	3	0.03	2.76	3	0.43	1.65	3	0.65

8 WT=8 word test; df=degrees of freedom; DS=digit span; Int. vs. Contr. = intervention group versus control group; SE=standard error; Time 1 = baseline; Time 2 = 3 months after baseline; Time 3 = 6 months after baseline; Time 4 = 9 months after baseline.

Table 3. continued Repeated measures models for the seven cognitive outcome variables.

	DS backward			Fluency			Incomplete figures		
Fixed effects	**Coefficient**	**SE**	**p-value**	**Coefficient**	**SE**	**p-value**	**Coefficient**	**SE**	**p-value**
Constant	3.44	0.54	<0.001	6.21	1.07	<0.001	2.98	0.55	<0.001
Time 1 (reference)	-	-	-	-	-	-	-	-	-
Time 2	-0.08	0.63	0.90	-1.18	1.03	0.25	0.06	0.56	0.91
Time 3	-0.90	0.62	0.15	-2.40	1.05	0.02	-0.17	0.55	0.76
Time 4	-1.77	0.76	0.02	-3.09	1.15	<0.01	-1.70	0.76	0.03
Group (Int. vs. Con.)	0.24	0.62	0.70	3.13	0.85	<0.001	0.92	0.65	0.16
Group*Time 2	-0.21	0.73	0.77	-	-	-	-	-	-
Group*Time 3	0.91	0.74	0.22	-	-	-	-	-	-
Group*Time 4	2.08	0.87	0.02	-	-	-	-	-	-
Random effects									
Level 2	3.93	0.77		33.55	3.21		5.58	1.00	
Level 1	2.81	0.35		0.00	0.00		2.19	0.28	
Deviance	1,033.64			1,390.87			947.07		
	χ^2	**df**	**p**	χ^2	**df**	**p**	χ^2	**df**	**p**
Interaction Group*Time	8.29	3	0.04	1.39	3	0.71	4.49	3	0.21

df=degrees of freedom; DS=digit span; Int. vs. Contr. = intervention group versus control group; SE=standard error; Time 1 = baseline; Time 2 = 3 months after baseline; Time 3 = 6 months after baseline; Time 4 = 9 months after baseline.

Table 4 Results of the GEE analysis and post-hoc analyses of paracetamol prescription.

Variables	Exp(B)	95% CI	p	χ^2	p
Time				*6.62*	*0.04*
Time1 (reference)	-	-	-		
Time 2	0.93	0.45; 1.89	0.83		
Time 3	0.64	0.28; 1.50	0.31		
Group				*2.64*	*0.10*
Control (reference)	-	-	-		
Intervention	2.01	0.87; 4.64	0.10		
*Group*Time*				*17.99*	*<0.001*
Int*Time2	0.48	0.20; 1.15	0.10		
Int*Time3	1.72	0.59; 5.03	0.33		
Post-hoc analyses					
Control group				*2.71*	*0.26*
Time1 (reference)	-	-	-		
Time 2	0.93	0.46; 1.89	0.84		
Time 3	0.66	0.28; 1.52	0.33		
Intervention gr.				*22.12*	*<0.001*
Time1 (reference)	-	-	-		
Time 2	0.45	0.27; 0.75	0.002		
Time 3	1.14	0.58; 2.23	0.70		

CI = confidence interval; Exp(B) = odds ratio; Int. = intervention group; Time 1 = baseline; Time 2 = 3 months after baseline, Time 3 = 6 months after baseline.

NSAID

The repeated measurement models examining the change in number of participants that have NSAID prescribed do not show a significant interaction between group and time. Subsequently no post-hoc analyses are performed (table 5).

Opioids

The repeated measurement models examining the change in number of participants that have opioids prescribed show a significant interaction between group and time. Further analysis of the prescription over time for the two groups separately shows no significant changes in the control group. In the intervention group there is a significant main effect for time, but for the individual periods (baseline – 3 months and baseline – 6 months) no significant relationship has been found (table 6).

Table 5 Results of the GEE analysis and post-hoc analyses of NSAID prescription.

Variables	Exp(B)	95% CI	p	χ^2	p
Time				*1.29*	*0.52*
Time1 (reference)	-	-	-		
Time 2	1.04	0.58; 1.86	0.89		
Time 3	1.37	0.71; 2.67	0.35		
Group				*0.002*	*0.97*
Control (reference)	-	-	-		
Intervention	1.02	0.35; 2.95	0.97		
*Group*Time*				*0.47*	*0.79*
Int*Time2	-	-	-		
Int*Time3	-	-	-		

CI = confidence interval; Exp(B) = odds ratio; Int. = intervention group; Time 1 = baseline; Time 2 = 3 months after baseline, Time 3 = 6 months after baseline.

Table 6 Results of the GEE analysis and post-hoc analyses of opioid prescription

Variables	Exp(B)	95% CI	p	χ^2	p
Time				*8.94*	*0.01*
Time1 (reference)	-	-	-		
Time 2	1.33	0.74; 2.39	0.34		
Time 3	1.31	0.75; 2.28	0.34		
Group				*0.43*	*0.51*
Control (reference)	-	-	-		
Intervention	1.07	0.20; 5.85	0.94		
*Group*Time*				*6.39*	*0.04*
Int*Time2	0.40	0.14; 1.15	0.08		
Int*Time3	0.40	0.14; 1.12	0.09		
Post-hoc analyses					
Control group				*1.11*	*0.29*
Time1 (reference)	-	-	-		
Time 2	1.07	0.94; 1.23	0.29		
Time 3	1.07	0.94; 1.23	0.29		
Intervention gr.				*10.32*	*0.006*
Time1 (reference)	-	-	-		
Time 2	0.60	0.22; 1.62	0.31		
Time 3	0.59	0.22; 1.58	0.29		

CI = confidence interval; Exp(B) = odds ratio; Int. = intervention group; Time 1 = baseline; Time 2 = 3 months after baseline, Time 3 = 6 months after baseline.

Discussion

In the present study the effect of structured pain assessment in psychogeriatric nursing home wards on pain medication prescription and cognitive functioning of the demented residents was examined. The results show that global cognitive functioning (MMSE) decreased significantly less over a period of nine months in the residents who underwent structured pain assessment, compared to residents who received unadjusted care. Also the performance on the Digit Span Backward dropt significantly more in participants from the control group, compared to the intervention group. No interaction effects were present for the other cognitive tasks. Additionally, the prescription rates of paracetamol and opioids indicate that there is an active pain treatment policy in the intervention group, but not in the control group. No significant interaction was present for the prescription of NSAID.

As far as the authors know this is the first study that examined the effect of structured pain assessment and hence more adequate pain treatment on cognitive functions in dementia patients. Our findings that implementation of the PACSLAC-D in daily nursing home care may have a positive effect on pain treatment is supported by a previous study that shows that implementation of the PACSLAC, scored at least three times a week, increases the amount of pain medication prescribed on an 'as needed' basis (Fuchs-Lacelle et al., 2008). The present study shows a significant time*group interaction effect for the prescription of paracetamol and opioids. Further analysis of the prescription over time per group shows that there were no changes in prescription of paracetamol and opioids in the control group. In the intervention group paracetamol prescription increased from baseline to 3 months, and decreased from 3 months to 6 months, indicating an active pain medication prescription policy. These results may be explained by the fact that in our intervention the PACSLAC-D was not only used to identify possible pain, but was additionally used as a tool to evaluate pain medication prescription. PACSLAC-D scores that were indicative for pain resulted in pain treatment, but in turn, in residents with existing pain medication prescription, scores on the PACSLAC-D that were not indicative for pain resulted in reducing or even terminating this medication. For opioids a

significant time effect was present in the intervention group as well, although no significant changes from baseline to 3 months and from baseline to 6 months were shown. No effect of the intervention on NSAID prescription was shown. These findings are in agreement with a previous study that showed that paracetamol and opioids are prescribed more commonly than NSAIDs in dementia patients (Haasum et al., 2011). The changes in prescription of paracetamol and opioids, but not NSAIDs, shown in our study are in line with recommendations concerning pain treatment in dementia patients (Herr et al., 2006). More specifically, in dementia patients with mild to moderate pain, Herr and co-workers (2006) recommend to start with Paracetamol 4 times a day (each time 500 mg to 1000 mg), and in the absence of the expected treatment effect, add a single low dose, short-acting opioid (e.g., hydrocodone, oxycodone, or morphine).

Considering the degenerative nature of diseases causing dementia, and hence the expected decrease in cognitive functioning (Burns et al., 1991), the stable performance on the MMSE and Digit Span backward in our intervention group, compared to the decrease in our control group, can be interpreted as a positive effect. Although the effect of pain assessment and treatment on cognitive functioning has not been studied before in dementia patients, support for this positive effect of pain reduction on cognition has been shown in chronic pain patients without dementia (Lorenz et al., 1997; Tassain et al., 2003). In these studies only the effect of morphine, a strong analgesic, on cognition was investigated. The present study did not show a positive effect on all neuropsychological tests used to measure cognitive functioning. A possible explanation for the positive findings is that as pain demands attention (Ecclestone and Crombez, 1999), relief of pain makes the attentional system available for others processes, which is mainly shown in an increase in the more global cognitive functions, as measured with the MMSE. A limitation of this study that may account for this lack of effect is the high level of difficulty of the used neuropsychological tests, which was probably too high for our study population. For this reason, in more than half of the available neuropsychological tests, the number of participants that were able to complete the tests was too low to include the tests in the data-analysis. In the cognitive outcome measure

that could be analysed, the scores were very low, suggesting that for some tests a floor-effect may be present.

A second limitation of this study is that the observation scale was not completed daily for each resident. Conversations with nurses revealed that implementing the structured pain assessment was not without difficulties, resulting in reduced compliance to the intervention. Some arguments for this reduced compliance were a lack of time and a lack of 'hands on the bedside', resulting in a high workload, which made it hard to implement this extra list. It has been recognised that making changes in routine daily practice is very difficult (Grol and Grimshaw, 2003). These problems mentioned by the nurses were also raised in a previous qualitative evaluation of caregivers' view on pain assessment and pain management (Martin et al., 2005). These findings suggest that the positive effects of structured pain assessment in nursing home residents may be even stronger when the assessment is applied more frequently.

Conclusion

The results of the present study show that structured pain assessment as part of routine daily care in psychogeriatric nursing homes has a positive effect on pain treatment and on cognitive functioning of the residents. The fact that the intervention was executed by the nurses, and not by the researches, suggests that the intervention can be successfully extended to other nursing homes.

References

Achterberg WP, Pot AM, Scherder EJ, Ribbe MW. Pain in the nursing home: assessment and treatment on different types of care wards. J Pain Symptom Manage 2007 Nov; 24: 480-7.

Andersen K, Launer LJ, Ott A, Hoes AW, Breteler MMB, Hofman A. Do non-steroidal anti-inflammatory - drugs decrease the risk for Alzheimer's disease? Neurology 1995; 45: 1441-45.

Apkarian AV, Sosa Y, Krauss BR, Thomas PS, Fredrickson BE, Levy RE, Harden RN, Chialvo DR. Chronic pain patients are impaired on an emotional decision-making task. Pain 2004; 108: 129-136.

Aubin M, Giguère A, Hadjistavropoulos T, Verreault R. [The systematic ecaluation of instruments designed to assess pain in persons with limited ability to communicate.] Pain Res Manag 2007; 12(3): 195-203.

Burns A, Jacoby R, Levy R. Progression of cognitive impairment in Alzheimer's disease. J Am Geriatr Soc 1991; 39(1): 39-45.

De Jong D, Jansen R, Hoefnagels W, Jellesma-Eggenkamp M, Verbeek M, Borm G, Kremer B. No effect of one-year treatment with indomethacin on Alzheimer's disease progression: a randomized controlled trial. PLoS One 2008; 3(1): e1474.

Eccleston C, Crobez G. Pain demands attention: a cognitive-affective model of the interruptive function of pain. Psychol Bull 1999; 125(3): 356-366.

Eeker ED, Vierkant RA, Mickel SF. Predictors of nursing home admission and/or death in incident Alzheimer's disease and other dementia cases compared to controls: A population-based study J Clin Epidemiol 2002; 55: 462-468.

Folstein MF, Folstein SE, McHugh PR: "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975, 12:189-198.

Frampton M. Experience assessment and management of pain in people with dementia. Age Aging 2003; 32: 248-251.

Fuchs-Lacelle S, Hadjistavropoulos T. Development and preliminary validation of the Pain Assessment Checklist for Seniors with Limited Ability to Communicate (PACSLAC). Pain Manag Nurs 2004 5(1): 27-49.

Fuchs-Lacelle S, Hadjistavropoulos T, Lix L. Pain assessment as intervention: a study of older adults with severe dementia. Clin J Pain 2008; 24(8): 697-707.

Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. Lancet 2003; 362: 1225-30.

Haasum Y, Fastbom J, Fratiglioni L, Kåreholt I, Johnell K. Pain treatment in elderly persons with and without dementia. A population-based study of institutionalized and home-dwelling elderly. Drugs Aging 2011; 28 (4): 283-93.

Herr K, Coyne PJ, Key T, Manworren R, McCaffery M, Merkel S, Pelosi-Kelly J, Wild L. Pain Assessment in the Nonverbal Patient: Position Statement with Clinical Practice Recommendations. Pain Manag Nurs 2006; 7 (2): 44-52.

Husebo BS, Strand LI, Moe-Nilssen R, BorgeHusebo S, Aarsland D, Ljunggren AE. Who suffers most? Dementia and pain in nursing home patients: a cross-sectional study. J Am Med Dir Assoc 2008; 9: 427-33.

Karp JF, Reynolds CF 3rd, Butters MA, Dew MA, Mazumdar S, Begley AE, Lenze E, Weiner DK. The relationship between pain and mental flexibility in older adult pain clinic patients. Pain Med. 2006; 7(5): 444-52.

Kuhajda MC, Thorn BE, Klinger MR, Rubin NJ. The effect of headache pain on attention (encoding) and memory (recognition). Pain 2002; 97: 213-221.

Kunz M, Mylius V, Scharmann S, Schepelman K, Lautenbacher S. Influence of dementia on multiple components of pain. Eur J Pain 2009; 13(3): 317-25.

Lindeboom J, Jonker C: Amsterdam Dementia Screening Test, Manual. [Amsterdamse Dementie-screeningtest, handleiding]. Lisse: Swets and Zeitlinger; 1989.

Lindsay J, Laurin D, Verreault R, Hébert R, Helliwell B, Hill GB, McDowell I. Risk factors for Alzheimer's disease: a prospective analysis from the Canadian study of health and aging. Am J Epidemiol 2002; 156: 445-53.

Lorenz J, Bromm B. Event-related potential correlates of interference between cognitive performance and tonic experimental pain. Psychophysiology 1997; 34: 436-45.

Luteijn F, van der Ploeg FAE: GIT. Groninger Intelligentie Test. Lisse, Swets & Zeitlinger, 1983.

Martin R, Williams J, Hadjistavropoulos T, Hadjistavropoulos HD, MacLean M. A qualitative investigation of seniors' and caregivers' views on pain assessment and management. Can J Nurs Res 2005; 37(2): 142-64.

Oosterman JM, Derksen LC, Van Wijck AJM, Veldhuijzen DS, Kessels RPC. Memory functions in chronic pain: examining contributions of attention and age to test performance. Clin J Pain 2011; 27: 70-75.

Plooij B, Van der Spek K, Scherder EJ. Pain medication and global cognitive functioning in dementia patients with painful conditions. Drugs Aging 2012; 29(5): 377-84.

Rasbash J, Steele F, Browne W J, Goldstein H. A user's guide to MLwiN, v2. 10. Centre for Multilevel Modelling, University of Bristol, 2009.

Scherder E, Oosterman J, Swaab D, Herr K, Ooms M, Ribbe M, Sergeant J, Pickering G, Benedetti F. Recent developments in pain in dementia. BMJ 2005; 330: 461-4.

Skoog I. Psychiatric epidemiolog of old age: the H70 study – the NAPE Lecture 2003. Acta Psychiatr Scand 2004; 109: 4-18.

Snijders T, Bosker R. Multilevel modeling: An introduction to basic and advanced multilevel modeling: Sage, 1999.

Stroop JR. Studies of interference in serial verbal reactions. Journal of Experimental Psychology 1935; 18: 643–662.

Tassain V, Attal N, Fletcher D, Brasseur L, Dégieux P, Chauvin M, Bouhassira D. Long term effects of oral sustained release morphine in neuropsychological performance in patients with chronic non-cancer pain. Pain 2003; 104: 389-400.

Tsang A, Von Korff M, Lee S, Alonso J, Karam E, Angermeyer MC, Borges GL, Bromet EJ, De Girolamo G, De Graaf R, Gureje O, Lepine JP, Haro JM, Levinson D, Oakley Brown MA, Posada-Villa J, Seedat S, Watanabe M. Common chronic pain conditions in developed and developing countries: gender and age differences and comorbidity with depression-anxiety disorders. J Pain 2008; 9(10): 883-91.

Vlad SC, Miller DR, Kowall NW, Felson DT. Protective effects of NSAIDs on the development of Alzheimer disease. Neurology 2008; 70(19):1672-7.

Wechsler D. A standardized memory test for clinical use. J Psychol 1945; 19: 87–95.

Wechsler D. Manual for the Wechsler Adult Intelligence Scale. New York: The Psychological Corporation, 1955.

Wechsler D. Manual for the Wechsler Memory Scale – Revised. New York: The Psychological Corporation, 1987.

Weiner DK, Rudy TE, Morrow L, Slaboda J, Lieber S. The relationship between pain, neuropsychological performance, and physical function in community-dwelling older adults with chronic low back pain. Pain Med 2006; 7(1): 60-70.

Wilson BA, Alderman N, Burgess PW, Emslie H, Evans JJ. Behavioural Assessment of the Dysexecutive Syndrome (BADS). Journal of Occupational Psychology,

Employment and Disability 2003, **5:**33-37.

Wilson B, Cockburn J, Baddely A: The Rivermead Behavioural Memory Test. Titchfield:Thames Valley Test Company; 1987.

Zwakhalen SMG, Hamers JPH, Abu-Saad HH, Berger MPF. Pain in elderly people with severe dementia: A systematic review of behavioural pain assessment tools. BMC Geriatr 2006a 27; 6: 3.

Zwakhalen SMG, Hamers JPH, Berger MPF. The psychometric quality and clinical usefulness of three pain assessment tools for elderly people with dementia. Pain 2006b; 126: 210-20.

Zwakhalen SMG, Hamers JPH, Berger MPF. Improving the clinical usefulness of a behavioural pain scale for older people with dementia. J Ad Nurs 2007; 58(5): 493-502.