

# The relationship between oral/dental pain and behavioural and psychological symptoms of dementia (BPSD) among elderly residents in nursing homes

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## Abstract

Oral care has been traditionally considered poor in nursing homes and increased dental problems have been associated in people with dementia. Whilst behavioural and psychological symptoms of dementia (BPSD) have been associated with pain in general, a link with dental pain has so far not yet been established. This study investigated the potential link between treatable dental problems (that might cause pain) and BPSD. Sixty five residents exhibiting BPSD were recruited in the study from three nursing homes in West Midlands. Patient cognitive and behavioural status was assessed using the Mini Mental State Examination (MMSE) and the Cohen-Mansfield Inventory (CMAI), and then subjected to dental screening using the Oral Health Assessment Tool (OHAT). The dental examination by a qualified dentist revealed no dental problems that required treatment or likely to cause pain in any of the participants. The results suggest that in this exploratory sample BPSD was not caused by dental problems or dental pain. More trials are necessary to establish whether dental or other types of pain are linked with BPSD and whether analgesic treatment versus antipsychotics will aid behavioural management.

Keywords: behavioural and psychological symptoms of dementia; dental pain; older people; dementia; nursing homes

## Background

Thirty five million people worldwide are reported to have dementia, with an expectation to rise to 115 million by 2050 (Dartigues, 2009). More than 50% of people with dementia experience behavioural disturbances, which is often the reason for placement into residential or nursing care (Hersch and Falzgraf, 2007). In nursing homes, between 60-80% of the residents are reported to display behavioural disturbances, in particular those with moderate to severe dementia (Cohen-Mansfield and Libin, 2005). Nursing home residents with dementia and behavioural disturbances are also described to be in daily pain in around 45-80 %, compared to community-dwelling older adults who experience daily pain in 35-48% of the cases (Husebo et al. 2008; Mahoney and Peters, 2008; Zwakhalen et al. 2009).

The aetiology of BPSD is multifactorial and can include brain changes, genetics, physical disease, any unmet needs, and pain. The identification of the various contributing factors can be difficult because the symptoms frequently overlap or coexist and they may also respond to similar treatment modalities (Ballard et al, 2011). Physical health problems such as infection, pain, and dehydration are common in people with dementia and can often precipitate BPSD, as can visual and auditory impairment (Chapman et al, 1999).

An association between pain and increased BPSD has been suggested (Husebo et al, 2013). As long-term nursing care patients progress to the moderate and severe levels of

dementia, their capacity to communicate that they are in pain to carers diminishes and pain is often expressed in the form of agitation and other behavioural disturbances (Hyochol and Horgas, 2013; Cipher, Clifford and Roper, 2006). These patients gradually lose their ability to process information so that they are less likely to express pain in typical way even when there is a probable cause for pain (Horgas, Elliot and Marsiske, 2009; Cohen-Mansfield, 2004). As a result, pain is often unreported in these populations (Hyochol and Horgas, 2013).

Behaviours like verbal complaints, negative vocalisations, sighing, moaning, crying, grimacing, rapid blinking, shifting/fidgeting, rubbing, resistance, bracing, guarding, and rigidity are common indicators of pain from the literature (Horgas et al, 2007). Oh, Eom and Kwon (2004) have also reported that aggressive behaviour in dementia patients is indicated as a sign of pain. Studies suggest that pain and other forms of physical suffering must be adequately treated in order to reduce behavioural disturbances and improve quality of life (Cipher, Clifford and Roper, 2006). It is suggested that affective pain management may help to reduce levels of aggression and agitation (Hyochol and Horgas, 2013; Cipher, Clifford and Roper, 2006). Literature reports of recent randomised controlled trials (RCTs) demonstrate significant reduction of BPSD symptoms by pain treatment in patients with moderate to severe dementia (Husebo et al, 2013). The first substantial randomised controlled trial into the role of pain management as a treatment for BPSD conducted in Norway by Ballard et al (2011) found that levels of agitation experienced by people taking painkillers over an eight week period reduced by an average of 17 per cent when compared to the people who received usual care.

Older people with advanced cognitive decline are in the highest risk for undertreatment or wrong treatment because of their inability to verbalise pain (Burfield et al 2012). Incorrectly assessing pain or even lack of assessment may lead to higher incidence of inappropriate medication use, medication side effects and individuals remaining in discomfort. Diagnosis of these patients with BPSD often leads to mistreatment i.e. inappropriate use of antipsychotic medication with additional high mortality rates. The Committee of Safety Medicines (2003) stated that antipsychotic medication is often inappropriately used as a means of managing BPSD, rather than to manage psychotic symptoms (40,000 wrongly prescribed). If support was available to provide alternative methods of managing behavioural problems, prescribing of antipsychotics could be reduced by up to two-thirds.

Therefore, the study of specific types of pain and their appropriate treatment, especially among those individuals who are non-communicative, could significantly improve quality of life and quality of care in nursing homes (Burfield, et al 2012; Ballard et al, 2011).

Dental pain in older people suffering from dementia is often underdetected and undertreated (Cohen-Mansfield and Lipson, 2002). Both inflammation and oral pain has been shown to contribute to cognitive, functional and behavioural impairments in ageing populations and aggravate the symptoms of patients with Alzheimer's disease (AD). A case report of a 74-year-old woman with AD and chronic facial pain demonstrated a significant improvement in functional activities as well as in cognition and depressive symptoms after successful treatment of her facial pain. Therefore, further investigation of orofacial pain in individuals with AD is suggested, as a result of this case study (de Siqueira et al, 2010).

Although some links have been identified between general pain and BPSD as well as dental pain and cognitive impairments, the authors have not been able to find any literature specifically linking dental pain with BPSD.

Consequently, the present study was conducted to investigate the potential link between oral/dental pain and BPSD in nursing home residents. The decision to investigate nursing home residents was due to the fact older people who live in nursing homes have been

reported to be at a greater risk for oral health problems than those who live independently (Williams, 2006).

## Method

### *Research design*

A single group pre-test/post-test design was employed to investigate the possible involvement of dental pain in nursing home residents with dementia who present with BPSD. According to this design, the group should be initially measured (pre-test/baseline), 01, then subjected to (dental) treatment, X, and measured again, 02 (post-test).

**01 → X → 02**

The independent variable is the treatable oral/dental problems as identified by the dentist (and it may vary in terms of severity or duration); the dependent variable is the BPSD as measured by the Cohen-Mansfield Inventory, having two levels: 1) pre-test (baseline) assessment, and 2) post-test: four weeks following onset of treatment. Biographical information of the participants was also collected. Access to the residents' medical history records was available following permission by the General Practitioner or consultant involved in their care.

### *Participants*

Sixty five residents with dementia exhibiting BPSD<sup>1</sup> were recruited to the study with mean age of 82.84±8.58 years. The youngest participant was 65 whilst the older was 99 years old. There were 28 males and 37 females. The number recruited was higher than the figure revealed by the power analysis (n=26), allowing for attrition. The participants were recruited from three nursing Elderly Mentally Infirm homes (EMI) in the West Midlands, United Kingdom. The inclusion/exclusion criteria for eligibility were as follows:

*Inclusion criteria:* Older adults aged 65 years or over, diagnosed with dementia, currently demonstrating BPSD, EMI home residents, pain relief (paracetamol, ibuprofen, etc.).

*Exclusion criteria:* Current mental illness, learning disability, severe visual/hearing impairment, residents on morphine or other substitutes, chronic pain, acute illness known to cause BPSD such as UTI, constipation, chest infection, etc.

### *Instruments/Materials*

*The Mini-Mental State Examination* (MMSE; Folstein, Folstein and McHugh, 1975) is a brief 30-point questionnaire test that is commonly used to screen for dementia and other cognitive impairments. A score of 24 is considered the cut-off under which a patient is considered to have a cognitive impairment. A score of 25 or greater indicates no cognitive impairment. This examination is not suitable for making a diagnosis but can be used to indicate the presence of cognitive impairment or to estimate the severity of cognitive impairment at a given point in time and to follow the course of cognitive changes in an individual over time.

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<sup>1</sup> Power analysis: For a medium effect size  $d=0.5$  (Cohen, 1988) and a power of 0.8, using a within subjects one-tailed t-test, we need a minimum of 26 participants at the post test.

*Cohen-Mansfield Agitation Inventory (CMAI;* Cohen-Mansfield, Marx, and Rosenthal, 1989) assesses the frequency of manifestations of agitated behaviours in elder adults. The CMAI was developed for use in nursing homes. It has been used also by family carers, nursing staff, social workers, activity directors of senior day care centres and others. Although originally developed for research purposes, it has also been used for clinical purposes. The scale takes about 10-15 minutes to complete.

It consists of 29 agitated behaviours, each rated on a 7-point scale of frequency. A total score would range from 29 (minimum) to 203 (maximum). Ratings pertain to the two weeks preceding the administration of the CMAI. For the analysis of the results, the 29 agitated behaviours were split into four subcategories:

- Physically Aggressive Behaviour (PAB) (items: 3, 7, 8, 9, 10, 11, 14, 15, 17, 21, 25, 28; Score range: 12-84)
- Physically Non Aggressive Behaviour (PNAB) (items: 1, 2, 5, 16, 20, 22, 23, 24, 26, 29; Score range: 10-70)
- Verbally Aggressive Behaviour (VAB) (items: 4, 12, 13, 27; Score range: 4-28)
- Verbally Non Aggressive Behaviour (VNAB) (items: 6, 18, 19; Score range: 3-21)

*The Oral Health Assessment Tool (OHAT)* (Chalmers and Pearson, 2005) is a simple, eight category screening tool to assess participants' oral health, including those with dementia. It assesses the health of the lips, tongue, gums and tissues, saliva, natural teeth (yes/no), dentures (yes/no), oral cleanliness and presence of dental pain. There are three potential scores in each category: 0=healthy; 1=changes; 2=unhealthy. The OHAT has been shown to be a reliable and valid screening assessment tool for use in residential care facilities, including those with cognitively impairments and dementia.

### *Procedure*

For the purpose of the recruitment of the participants, the following procedure took place in the selected EMI homes (Figure 1).

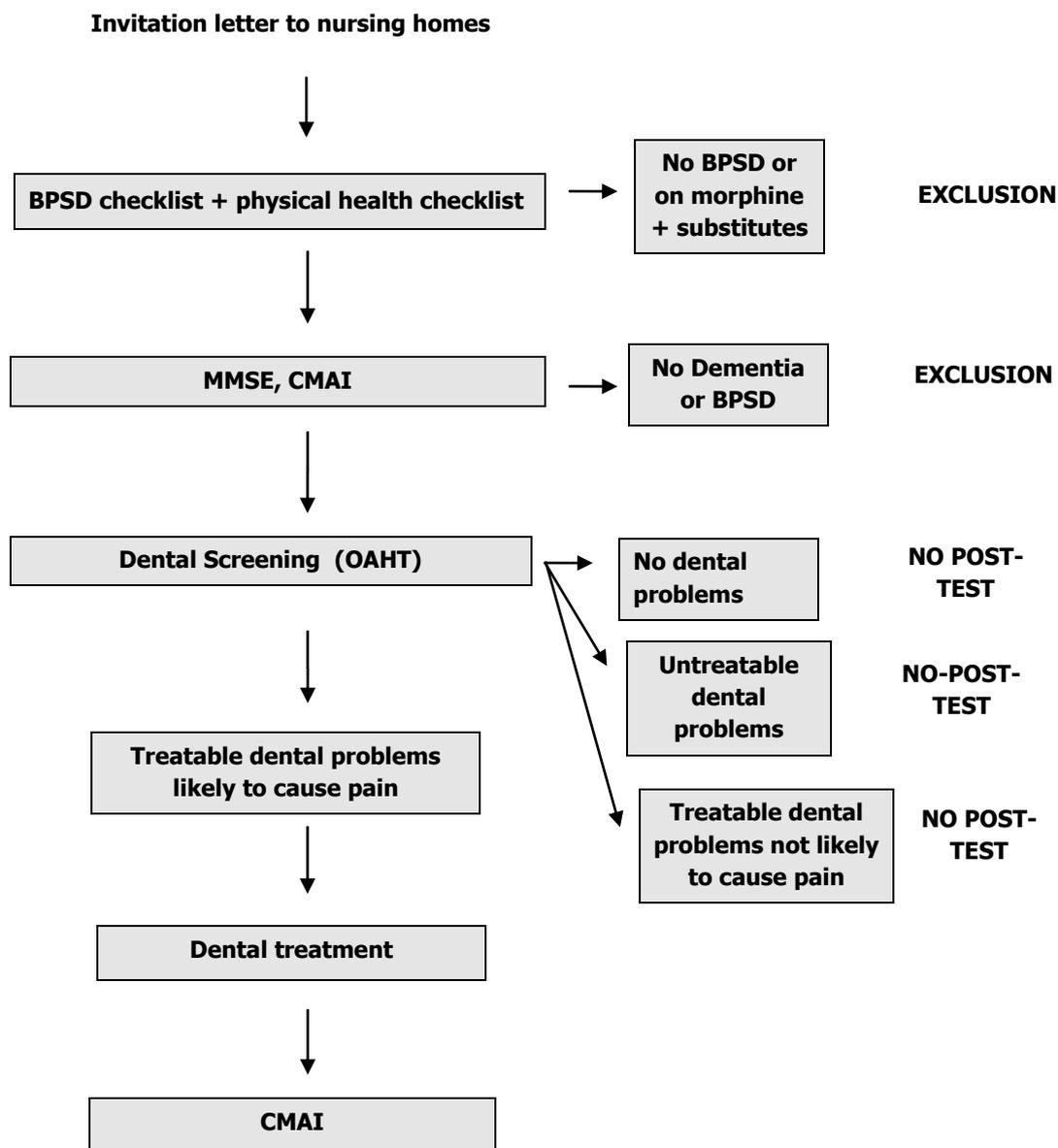
A letter of invitation to participate in the project was sent to all EMI nursing home managers in the geography chosen, accompanied by an Information sheet about the research. Nursing staff in each participating nursing home recorded all residents who have BPSD based on a BPSD symptoms list, which was specially designed by a clinician (member of the research team) for non specialist use. All residents who had at least one symptom of the BPSD list were eligible as potential participants for the research.

Any additional sources of possible pain caused by physical health problems (such as backache, arthritis or UTI) were also recorded. Appointments were made convenient to the nursing home staff and residents. Every effort was exhausted to meet the potential participants in their bedroom in order to maintain privacy and avoid potential noise and distractions. However, where this was not possible, the meeting took place in the main lounge.

All potential participants were screened for mental capacity (using the three question capacity assessment) to establish if they were able to give informed consent for their participation. If they had capacity, then they were given the information sheet (simplified) and consent form to decide if they would like to participate. If they had no capacity, then patient relatives/friends were contacted as consultees to advice this process. If no friend or relative was available, then the nurse in charge would take the role of the consultee to sign the declaration form in the patient's best interest. All the recorded potential BPSD participants who enrolled in the study were screened with the MMSE. At this point, the CMAI was also applied to confirm the presence of BPSD. The participants who were diagnosed with BPSD underwent a simple dental screening by a qualified dentist within two weeks from

the pre-test assessment. The dental screening took place in the nursing home by the dentist using the OAHT. Participants with treatable oral/dental problems would receive treatment. Participants who received treatment would be followed up in order to compare the CMAI post-treatment measurements with the pre-treatment and establish if there was any change in the BPSD symptoms.

**Figure 1.** Summary of study recruitment and assessment procedures.



### Ethics

This study was approved by Staffordshire University Faculty of Health Sciences Independent Peer Review Panel and the Cambridgeshire 3 Social Care Research Ethics Committee in the United Kingdom.

## Results

The dental examination revealed no dental problems that required treatment in any of the participants of the three nursing homes. Consequently, there was no follow up behavioural assessment. Main descriptive statistics, in the form of means and standard deviations are presented along with relevant graphs where appropriate to give a more comprehensive overview of the outcomes. The results presented were analysed employing quantitative techniques using SPSS 21.

### *Participation rates and participants' biological information*

One hundred and twelve residents in total were initially listed by the nurses in charge in the three recruited homes as potential participants. A further screening by the researcher and the nurses revealed that 28 out of the 112, had no BPSD symptoms according to the BPSD screening checklist, and a further three displayed behavioural symptoms but did not have dementia (according to their records). This left 83 residents with BPSD eligible for the study. From these, five refused to participate (four with capacity and one consultee). A further two died after the pre-test but before the dental examination. An additional seven did not cooperate during the meeting due to BPSD, hence they had to be excluded, and finally, four residents did not meet the BPSD criteria according to the CMAI at the pre-test assessment, even though the initial screening has demonstrated presence of some BPSD symptoms. Therefore, 65 residents out of the initial 112 participated in the study.

### *Medication*

Table 1 demonstrates that the majority of residents were not taking any medication.

**Table 1.** Medication types

Medication type	n
no medication	34
pain relief only	16
antipsychotics only	6
pain relief and antipsychotics	9
Total	65

### *Pre-test/baseline assessment*

Capacity: From the 65 participants, 58 had no capacity to give informed consent, thus consultees were appointed to aid the consent process. Seven had capacity and gave informed consent. From the five who refused to take part in the study, four had capacity and one had no capacity.

Mini Mental State Examination (MMSE): The MMSE assessments revealed a mean score of 5.03 out of (a maximum) 30 (Table 2). Many participants obtained a score of zero (n= 29). This result was primarily due to communication difficulties, for example lack of speech or irrelevant responses. A further 23 scored 1-11 whilst only 13 had a score 12-23.

**Table 2.** MMSE assessments.

Assessment	N	Min	Max	Mean	SD
MMSE	65	0	23	5.03	6.68

A Pearson r correlation was computed to assess the association between mental capacity and MMSE scores. A positive relationship was found between mental capacity and MMSE scores,  $r = 0.485$ ,  $n=65$ ,  $p<0.001$ , indicating that the lower the cognitive scores the more people lacked capacity.

Cohen Mansfield Inventory (CMAI): The CMAI results in all four sub-categories are presented in Table 3, below.

**Table 3.** CMAI assessments

CMAI category	N	Min	Max	Mean	SD
PAB (12-84)	65	12	60	27.72	12.19
PNAB (10-70)	65	10	54	27.04	11.16
VAB (4-28)	65	4	22	10.23	4.51
VNAB (3-21)	65	3	21	9.27	5.14

A Pearson r correlation was computed to assess the association between MMSE scores and CMAI categories. A positive relationship was identified between MMSE scores and PNAB,  $r = 0.358$ ,  $n=65$ ,  $p<0.01$ , and between MMSE scores and VNAB,  $r = 0.357$ ,  $n=65$ ,  $p<0.01$ . No significant relationship was found between MMSE scores and PAB or MMSE and VAB. The results indicate that the lower the cognitive scores, the lower the physical and verbal non aggressive behaviours.

#### *Dental examination*

There were no oral or dental problems in any of the participants who underwent dental examination that were likely to cause pain. In addition, no participants required dental treatment of any type. One participant, who reported dental pain, had a sore spot under the dentures and was prescribed an oral solution as a relief; however, no dental treatment was necessary. As it can be seen in Table 4 below, it is notable that nearly half of the participants had no teeth, 14 had dentures, whilst only 21 out of 65 still retained some of their own teeth.

**Table 4.** Participants' teeth condition.

Condition	n=	%
no teeth/no dentures	30	46.2
no teeth/dentures	14	21.5
own teeth	21	32.3

## **Discussion**

The study objective was to determine whether there was a link between oral/dental pain and BPSD in older nursing home residents. To date there has been no similar published research that has investigated that link. No participants in any of the three nursing homes were identified with dental problems that were likely to cause pain or require treatment; hence no follow up assessment was deemed necessary.

According to the results, a large number of participants obtained a very low cognitive score as screened with the MMSE. All these participants also displayed BPSD. A positive relationship was identified between participants' cognitive scores and two of the BPSD

subscales as measured by the CMAI. The study findings are consistent with the study of Fernandez et al (2010), which showed that there is a correlation between the severity of cognitive impairment (MMSE scores) and BPSD. The Cache County Study also reported that a greater severity of dementia was associated with an increased presence of all the BPSD included on the Neuropsychiatric Inventory (NPI) except for depression. (Savva et al, 2009). Nevertheless, in the present study, the behaviours that correlated with the cognitive scores were the physical and verbal non aggressive behaviours such as such as general restlessness, repetitious mannerisms, pacing, trying to get to a different place, handling things inappropriately, hiding, and inappropriate dressing or undressing, negativism, not liking anything, constant requests for attention, verbal bossiness, complaining or whining, relevant interruptions, irrelevant interruptions, and repeating sentences. This finding is very interesting as literature has previously demonstrated that this particular group of behaviours do not indicate signs of pain (Hyochol and Horgas, 2013), which is also consistent with the assessment of the qualified dentist. This finding demonstrates that the participants who were severely cognitively impaired and had difficulty of communication, did not display physical or verbal aggressive behaviours which have been related to pain. Even though there was a manifestation of some degree of verbal and physical aggressive behaviours, these did not significantly correlate with the cognitive scores. The results indicate that these participants who had difficulty in communication due to severe cognitive impairment did not display aggressive behaviours that indicate pain.

A significant positive correlation was found between MMSE scores and capacity to give informed consent, indicating that the lower the cognitive score the lower the capacity to give consent, which is an expected finding. This outcome was consistent with a study of Gregory et al (2007) who also reported that MMSE score as a significant predictor of capacity to give consent. Our study results reinforce their suggestion that MMSE could be used as a screening tool to help inform a clinical capacity assessment in people with Alzheimer's disease and other dementias. Almost half of the participants in the study of Gregory et al (2007) with the moderate and severe degree of cognitive impairment had no capacity. The vast majority of participants in our study, 58 out of 65, had severe degree of cognitive impairment and no capacity to give informed consent to participation and this was successfully picked up by the MMSE screening.

The presence of BPSD in care home settings frequently leads to the inappropriate prescription of antipsychotic drugs as a first line treatment, with 40-60% of nursing home residents with dementia prescribed such treatment (Husebo et al, 2011). Increasing evidence from the literature highlights the fact that atypical antipsychotics have modest but significant short term benefits over a 6-12 week period in the treatment of aggression. However in the longer term, they are associated with substantial adverse effects including amongst others accelerated cognitive decline (Ballard and Howard, 2006). In our study, even though only 23% of participants were on some form of antipsychotic medication compared to 40-60% reported elsewhere, this might be an explanation for the severe cognitive decline in our study group. Evidence from several well conducted RCTs highlights the value of psychological interventions such as structured social interaction, simulated presence therapy and personalised music, as well as more comprehensive interventions delivered by a clinical psychologist and person centred training of care home staff. These non-pharmacological interventions have been associated with a significant reduction in BPSD and also in the use of antipsychotic drugs as reported in respective studies (Ballard, 2012). The homes that participated in our study had non pharmacological interventions in place, such as structured social interaction through play (chess, puzzles, etc), music, foot massage, etc. This finding seems to be consistent with Ballard's suggestion where the homes are tried to reduce the use of antipsychotic medication in their patients and increase the use on non-

pharmacological interventions. There is excellent evidence that non-pharmacological interventions are efficacious for the treatment of BPSD in care homes (Ballard, 2012).

Further, it has been highlighted that effective pain treatment is a key part in reducing the use of antipsychotic drugs, and a potential first line management strategy for BPSD (Ballard and Corbett, 2013). The current evidence base also seems to suggest that even in those people without explicit pain, analgesia may still be a useful treatment option for agitation and other BPSD (Ballard, et al, 2011). However it seems that the rate of analgesic use in people with dementia is still far lower than in healthier older adults (Husebo et al, 2011). Therefore the suspected undiagnosed and untreated pain is likely to contribute to levels of agitation and other BPSD (Ballard et al, 2011). In our study, less than half of the participants (n=25) were in some sort of pain relief treatment. Even though there was no reported dental pain, there could be other types of pain that could be responsible for the agitation. As a result of the severe impairment and lack of capacity, most participants were unable to communicate if they are in any form of pain or other discomfort that would account for their challenging behaviours. Further study is necessary to test this association.

The study outcome indicates that the general dental/oral care amongst the dementia residents in nursing homes in this study did not cause any concern and BPSD is not linked to dental/oral pain in this particular study population. This finding appears to contradict numerous studies that reported older people with dementia being particularly prone to developing complex oral and dental problems (Syrjälä et al, 2012; Stewart & Hirani, 2007, Chalmers and Pearson, 2005). One explanation could be due to the fact that the study was limited to only three EMI homes in the West Midlands rather than a variety of homes in a wider geographical location, more representative to the target population, where the residents in these particular homes might have had regular check-ups by the dentist, hence better quality of oral care compared to the reported studies. Alternatively, there is a possibility that these findings are due to the high number of study participants having no teeth (44 out of 65) compared to their European counterparts (sans teeth = sans pain).

The issue of lack of teeth raises the concern of poor nutrition as has been reported in previous literature (Soini et al, 2006) and perhaps in turn with BPSD as the poor nutrition and inability to communicate hunger due to severe cognitive decline may lead to the presence of BPSD. Further investigation is necessary to explore this link further in the UK population.

Finally, the study had a good methodological design which could be applied again to future studies/areas of research. However as discussed, there may be a need to broaden the study by increasing the number of homes as well as that of participants. This could also be improved by involving home nursing staff and providing training on screening for different types of pain, to ensure better and timely pain detection, or poor nutrition and other factors that might play a role in the presence of BPSD. This might facilitate the selection of appropriate treatments, instead of antipsychotic medication use, reduction of BPSD symptoms and increase in the quality of life for older people with dementia in nursing care home settings.

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## References

Ballard C (2012) Behavioral alternatives to antipsychotic prescribing for people with dementia in residential care settings, *Alzheimer's and Dementia*, vol.8, no.4, pp.1552-5260.

Ballard C & Corbett A (2013) Agitation and aggression in people with Alzheimer's Disease, *Current Opinion in Psychiatry*, vol.26, pp.252-259.

Ballard C & Howard R (2006) Neuroleptic drugs in dementia: benefit and harm, *Nature Reviews Neuroscience*, vol.7, no.6, pp.492-500.

Ballard C, Smith J, Husebo B, Aarsland D & Corbett A (2011) The role of pain treatment in managing the behavioural and psychological symptoms of dementia (BPSD), *International Journal of Palliative Nursing*, vol.17, no.9, pp.420-424.

Burfield AH, Wan TT, Sole ML & Cooper JW (2012) A study of longitudinal data examining concomitance of pain and cognition in an elderly long-term care population, *Journal of Pain Research*, vol.5, pp.61.

Chalmers J & Pearson A (2005) Oral hygiene care for patients with dementia: a literature review, *Journal of Advanced Nursing*, vol.52, no.4, pp.410-419.

Chapman FM, Dickinson J, McKeith I & Ballard C (1999) Association among Visual Hallucinations, Visual Acuity, and Specific Eye Pathologies in Alzheimer's Disease: Treatment Implications, *American Journal of Psychiatry*, vol.156, pp.1983-1985.

Cohen-Mansfield J & Libin A (2005) Verbal and physical non-aggressive agitated behaviors in elderly persons with dementia: robustness of syndromes, *Journal of Psychiatric Research*, vol. 39, pp.325-32.

Cohen-Mansfield J & Lipson S (2002) Pain in cognitively impaired nursing home patients: How well are physicians diagnosing it? , *Journal of the American Geriatrics Society*, vol.50, no.6, pp.1039-1044.

Cohen-Mansfield J & Lipson S (2002) The underdetection of pain of dental etiology in persons with dementia, *American Journal of Alzheimer's Disease & Other Dementias*, vol.17, no.4, pp.249-253.

Cohen-Mansfield J, Marx M & Rosenthal A (1989) A description of agitation in a nursing home, *Journal of Gerontology: Medical Sciences*, vol.44, no.3, pp.M77-M84.

Cohen-Mansfield J (2004) The social environment of the agitated nursing home resident, *International Journal of Geriatric Psychiatry*, vol.7, no.11, pp.789-798.

Cipher DJ, Clifford PA & Roper KD (2006) Behavioral Manifestations of Pain in the Demented Elderly, *Journal of the American Medical Directors Association*, vol.7, pp.355-365.

Dartigues JF (2009) Alzheimer's disease: a global challenge for the 21st century, *Lancet Neurology*, vol.8, pp.1082-3.

Folstein MF, Folstein S & McHugh PR (1975) Mini-Mental State: a practical method for grading the cognitive state of patients for the clinician, *Journal of Psychiatric Resources*, vol.12, pp.189-198.

Gregory R, Roked F, Jones L & Patel P (2007) Is the degree of cognitive impairment in patients with Alzheimer's disease related to their capacity to appoint an enduring power of attorney?, *Age and Ageing*, vol.36, pp.527-531.

Hersch EC & Falzgraf S (2007) Management of the behavioral and psychological symptoms of dementia, *Clinical Interventions Aging*, vol.2, no.4, pp.611-21.

Horgas AL, Elliott AF & Marsiske M (2009) Pain Assessments in Persons with Dementia: Relationship between Self-report and Behavioral Observation, *Journal of the American Geriatric Society*, vol.57, no.1, pp.126-132.

Horgas AL, Nichols AL, Schapson CA & Vietes K (2007) Assessing pain in persons with dementia: relationships among the non-communicative patient's pain assessment instrument, self-report, and behavioral observations, *Pain Management Nursing*, vol.8, no.2, pp.77-85.

Hyochol A & Horgas A (2013) The relationship between pain and disruptive behaviors in nursing home resident with dementia, *BMC Geriatrics*, vol.13, no.14.

Husebo BS, Ballard C, Cohen-Mansfield J, Seifert R & Aarsland D (2013) The Response of Agitated Behavior to Pain Management in Persons with Dementia, *American Journal of Geriatric Psychiatry*, vol.22, no.7, pp.708-717.

Husebo BS, Ballard C, Sandvik R, Nilsen OB & Aarsland D (2011) Efficacy of treating pain to reduce behavioural disturbances in patients of nursing homes with dementia: cluster randomised clinical trial, *British Medical Journal*, vol.343.  
doi: <http://dx.doi.org/10.1136/bmj.d4065>

Husebo BS, Strand LI, Moe-Nilssen R, BorgeHusebo S et al (2008) Who Suffers Most? Dementia and Pain in Nursing Home Patients: A Cross-sectional Study, *Journal of the American Medical Directors Association*, vol.9 no.6, pp. 427-433.

Leong IY & Nuo TH (2007), *Clinical Journal of Pain*, vol.23, no.2, pp.119-127.

Mahoney AE & Peters L (2008) The Mahoney pain scale: examining pain and agitation in advanced dementia, *American Journal Alzheimers Disease*, vol.23, pp.250-261.

Oh H, Eom M & Kwon Y (2004) A study on aggressive behaviour among nursing home patients with cognitive impairments, *Journal of Korean Academy of Nursing*, vol.34, pp.1451-1459.

Savva GM, Zaccai J, Matthews FE, Davidson JE, McKeith E & Brayne C (2009) Prevalence, correlates and course of behavioural and psychological symptoms of dementia in the population, *British Journal of Pain*, vol.194, pp.212-219.

de Siqueira SR, de Souza Rolim T, Teixeira MJ, Nitrini R, Anghinah R & de Siqueira JT (2010) Oral infections and orofacial pain in Alzheimer's disease: Case report and review. *Dementiae Neuropsychologia*, vol.4, pp.145–150.

de Siqueira SR, Teixeira MJ & de Siqueira JT (2013) Orofacial pain and sensory characteristics of chronic patients compared with controls, *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*, vol.115, no.6, pp.37-45.

Soini H, Muurinen S, Routasalo P, Sandelin E, Savikko N, Suominen M, Ainamo A & Pitkala KH (2006) Oral and nutritional status – is the MNA a useful tool for dental clinics, *Journal of Nutrition Health and Ageing*, vol.10, pp.495–501.

Stewart R & Hirani V (2007) Dental Health and Cognitive Impairment in an English National Survey Population, *Journal of the American Geriatrics Society*, vol.55, pp.1410-1414.

Syrjälä AM, Ylöstalo P, Ruoppi P, Komulainen K, Hartikainen S, Sulkava R & Knuuttila M (2012) Dementia and oral health among subjects aged 75 years or older, *Gerodontology*, vol.29, no.1, pp.36-42.

Williams L (2006) *Liability landscape: Don't overlook your patients' oral health*. Available from: [www.nursinghomesmagazine.com](http://www.nursinghomesmagazine.com)

Zwakhalen SM, Koopmans RT, Geels PJ & Berger MP (2009) The prevalence of pain in nursing home patients with dementia measured using an observational pain scale, *European Journal of Pain*, vol.13, no.1, pp.89-93.