RESEARCH ARTICLE

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Prevalence of pseudobulbar affect symptoms and clinical correlates in nursing home residents

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Objective: Pseudobulbar affect (PBA) is a neurological disorder of emotional expression, characterized by uncontrollable episodes of crying or laughing in patients with certain neurological disorders affecting the brain. The purposes of this study were to estimate the prevalence of PBA in US nursing home residents and examine the relationship between PBA symptoms and other clinical correlates, including the use of psychopharmacological medications.

Methods: A retrospective study was conducted between 2013 and 2014 with a convenience sample of residents from nine Michigan nursing homes. Chronic-care residents were included in the "predisposed population" if they had a neurological disorder affecting the brain and no evidence of psychosis, delirium, or disruptive behavior (per chart review). Residents were screened for PBA symptoms by a geropsychologist using the Center for Neurologic Study-Lability Scale (CNS-LS). Additional clinical information was collected using a diagnostic evaluation checklist and the most recent Minimum Data Set 3.0 assessment.

Results: Of 811 residents screened, complete data were available for 804, and 412 (51%) met the criteria for the "predisposed population." PBA symptom prevalence, based on having a CNS-LS score $\geq$13, was 17.5% in the predisposed population and 9.0% among all nursing home residents. Those with PBA symptoms were more likely to have a documented mood disorder and be using a psychopharmacological medication, including antipsychotics, than those without PBA symptoms.

Conclusions: Pseudobulbar affect symptoms were present in 17.5% of nursing home residents with neurological conditions, and 9.0% of residents overall. Increasing awareness and improving diagnostic accuracy of PBA may help optimize treatment. © 2015 The Authors. *International Journal of Geriatric Psychiatry* Published by John Wiley & Sons Ltd.

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Introduction

Pseudobulbar affect (PBA) is an under-recognized and underdiagnosed neurological disorder of emotional expression, characterized by frequent, exaggerated, and uncontrollable episodes of crying and/or laughing that are disproportionate to the patient's internal emotional state or social context (Schiffer and Pope, 2005; Wortzel *et al.*, 2008; Parvizi *et al.*, 2009). PBA is believed to occur as the result of disruption to the neurological pathways that regulate emotional expression (Parvizi *et al.*, 2009; Work *et al.*, 2011). Several distinct neurological disorders can cause this disruption, including, but not limited to, amyotrophic lateral sclerosis, stroke, multiple sclerosis (MS), Parkinson's disease (PD), Alzheimer's disease (AD), and traumatic brain injury (Schiffer and Pope, 2005; Wortzel *et al.*, 2008).

Stroke, AD, and PD are common in nursing home residents, suggesting that PBA may occur frequently in this population. However, the prevalence of PBA symptoms has never been formally measured among nursing home residents. A recently published analysis using the Centers for Medicare and Medicaid Services, Minimum Data Set, version 2.0 (MDS 2.0) found that 9.1% of nursing home residents had documented crying and tearfulness, symptoms suggestive of PBA (Zarowitz and O'Shea, 2013). Published estimates of PBA symptom prevalence in community-dwelling adults with AD, PD, or stroke vary widely, ranging from less than 10% to over 50% (House *et al.*, 1989; Morris *et al.*, 1993; Starkstein *et al.*, 1995; Calvert *et al.*, 1998; Kim and Choi-Kwon, 2000; Kim *et al.*, 2002; Lopez *et al.*, 2003; Tang *et al.*, 2004; Petracca *et al.*, 2009; Phuong *et al.*, 2009; Siddiqui *et al.*, 2009; Tang *et al.*, 2009; Fort, 2010; Strowd *et al.*, 2010; Miller *et al.*, 2011; Work, *et al.*, 2011; Choi-Kwon *et al.*, 2012; Brooks *et al.*, 2013).

Pseudobulbar affect diagnosis and management are important in nursing home patients, given the profoundly negative impact PBA may have on social functioning, psychological well-being, and quality of life (Shaibani *et al.*, 1994; Arciniegas and Topkoff, 2000; Colamonico *et al.*, 2012). However, overlap with comorbid psychiatric disorders and confusion regarding differential diagnosis, especially with depression (PBA versus mood disorder, or both), pose challenges for adequately identifying and managing PBA (Arciniegas and Lauterbach, 2005; Work *et al.*, 2011). As a result, antipsychotics, antidepressants, and anxiolytics are often used to manage PBA symptoms, despite the lack of substantial clinical evidence supporting their use for this indication (Lövheim *et al.*, 2006; Brooks *et al.*, 2013; Stefanacci *et al.*, 2014).

The primary objective of this study was to estimate the prevalence of PBA symptoms in a sample of US nursing home residents. Secondary objectives were to evaluate the relationship between PBA symptoms and other clinical/behavioral correlates, based on the clinical evaluation checklist and MDS (3.0), including the presence of cognitive impairment, psychiatric symptoms or diagnoses, and the use of antipsychotics and other psychopharmacological medications.

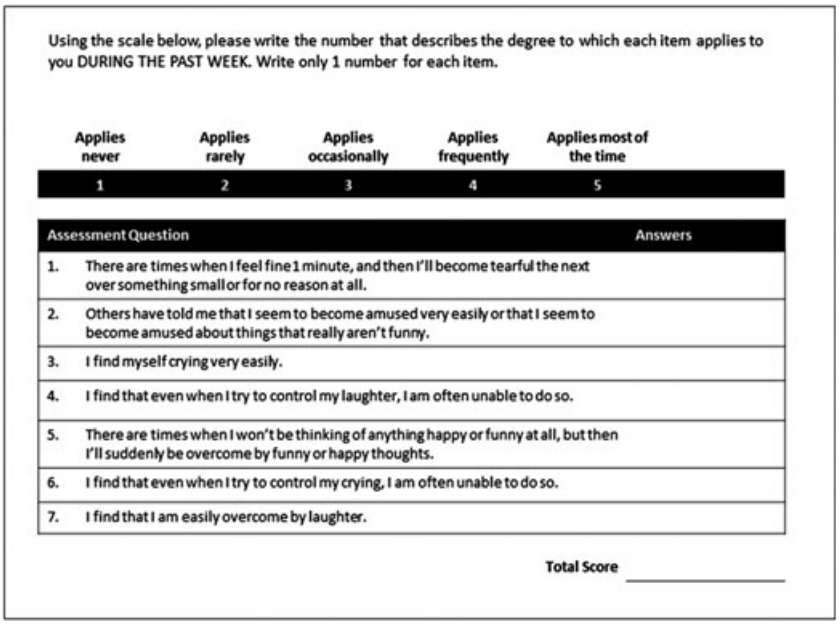
Methods

This observational study was conducted between 2013 and 2014 in a convenience sample of residents from nine unaffiliated nursing homes in central-western Michigan. Charts of all chronic-care residents were screened, including data from each resident's most recent MDS, version 3.0 (MDS 3.0) assessment (Centers for Medicare and Medicaid Services, 2010). A subset of this sample was considered to be predisposed to PBA symptoms (hereafter "the predisposed population"). Residents were included in the predisposed population if they had a documented diagnosis of a neurological disorder that could be associated with PBA (dementia, cerebral palsy, aphasia, stroke, PD, seizure, hemiplegia, and MS). Those with an existing diagnosis of psychosis, delirium, or disruptive behavior were excluded, because of the potential overlap of the associated symptoms with the clinical syndrome of PBA (Cummings *et al.*, 2006).

A geropsychologist with no preexisting relationship with the study nursing homes screened residents for PBA symptoms using the Center for Neurologic Study-Lability Scale (CNS-LS), which was completed by either the resident or the facility care staff (Figure 1). The CNS-LS is a patient-reported instrument that measures the frequency and severity of PBA symptoms and has been used to screen for PBA symptoms in research studies. The CNS-LS was validated in amyotrophic lateral sclerosis and MS patients, where scores $\geq$13 and $\geq$17, respectively, best predicted physician diagnosis of PBA (Moore *et al.*, 1997; Smith *et al.*, 2004). A score $\geq$13 was used to indicate the presence of PBA symptoms in this study.

The investigator also worked with the facility care staff to complete a diagnostic evaluation checklist (Table 1), adapted from a set of PBA diagnostic criteria proposed by Cummings and colleagues (Cummings *et al.*, 2006). This provided additional information regarding the context of the symptoms (affect), which is generally less apparent than the symptoms themselves (crying and laughing). The relationship between the presence of PBA symptoms (defined by CNS-LS score$\geq$13) and the context of the symptoms, based on the presence of one or more items from the clinical evaluation checklist, was assessed (Table 1).

Clinical/behavioral data were also extracted from each resident's most recent MDS 3.0 (Centers for Medicare and Medicaid Services, 2010). First, the presence of cognitive impairment, based on results from the Brief Interview for Mental Status (BIMS), was compared between those with and those without PBA symptoms (defined by CNS-LS score$\geq$13). The BIMS evaluates memory and orientation, using information collected within the MDS 3.0 (Centers for Medicare and Medicaid Services, 2010). It has



Using the scale below, please write the number that describes the degree to which each item applies to you DURING THE PAST WEEK. Write only 1 number for each item.

Applies never	Applies rarely	Applies occasionally	Applies frequently	Applies most of the time
1	2	3	4	5

Assessment Question	Answers
1. There are times when I feel fine 1 minute, and then I'll become tearful the next over something small or for no reason at all.	
2. Others have told me that I seem to become amused very easily or that I seem to become amused about things that really aren't funny.	
3. I find myself crying very easily.	
4. I find that even when I try to control my laughter, I am often unable to do so.	
5. There are times when I won't be thinking of anything happy or funny at all, but then I'll suddenly be overcome by funny or happy thoughts.	
6. I find that even when I try to control my crying, I am often unable to do so.	
7. I find that I am easily overcome by laughter.	

Total Score _____

Figure 1 Center for Neurological Study-Lability Scale for PBA. This previously developed and validated scale (Moore *et al.*, 1997; Smith *et al.*, 2004) was used to screen residents for PBA symptoms. PBA pseudobulbar affect.

Table 1 PBA diagnostic evaluation checklist[a]

Necessary elements
• Episodes of involuntary or exaggerated emotional expression that result from a brain disorder; including episodes of laughing, crying, or related emotional displays. • Episodes represent a change from the person's usual emotional reactivity. • Episodes may be incongruent with the person's mood or in excess of the corresponding mood state. • Episodes are independent or in excess of any provoking stimulus.

PBA, pseudobulbar affect.
[a]Adapted from Cummings *et al.*, 2006.

demonstrated higher correlation with the Modified Mini-Mental State Examination than alternatives such as the Cognitive Performance Score (Chodosh *et al.*, 2008; Saliba *et al.*, 2012). Finally, the use of psychopharmacological medications (including antipsychotics, anxiolytics, and antidepressants) and the presence of mood disorders (anxiety, depression, and bipolar disorder) were also compared between those with and those without PBA symptoms.

This research was carried out with the approval of the Compass Institutional Review Board (IRB). Residents or legal guardians provided informed consent for participating in the clinical evaluation by the geropsychologist; consent was not required by the IRB for the chart review.

Results

Of the 811 chronic-care residents screened, seven were dropped from the analyses because available data were inadequate for assessing inclusion/exclusion criteria. This left an analytical sample of 804 residents. A total of 412 residents (51%) met the eligibility criteria and were included in the predisposed population. Mean (standard deviation) age was 81.2 (12.5) years, and residents were primarily female (66.5%) and White (90.0%; Table 2). Demographic characteristics of the predisposed population were similar to those of the overall population of nursing home residents in the study (Table 2).

Within the predisposed population, 72 residents had a CNS-LS score $\geq$13, suggesting the presence of PBA symptoms in these individuals. This translates to a prevalence of PBA symptoms of 17.5% in the predisposed population (those with neurological disorders and without psychosis or disruptive behavior) and 9.0% among all nursing home residents.

Demographic characteristics for the predisposed population with PBA symptoms (CNS-LS score$\geq$13) and without PBA symptoms (CNS-LS score$<$13) are compared in Table 2. Those with PBA symptoms were significantly more likely to be female (77.8% vs. 64.1%, $p=0.026$), and marginally more likely to be White (95.8% vs. 88.8%, $p=0.071$) compared with those without PBA symptoms. The most common neurological diagnosis within the predisposed population was dementia, followed by stroke (Figure 2).

Table 2 Demographic characteristics

Demographic	All residents ($N = 804$)	Predisposed population[a]			p-value [c]
		Combined ($n = 412$)	With PBA symptoms[b] ($n = 72$)	Without PBA symptoms[b] ($n = 340$)	
Age, year					
Mean (SD)	79.9 (12.6)	81.2 (12.5)	79.6 (12.6)	81.6 (12.5)	0.22
Range	38.6–107.2	40.2–107.2	—	—	
Sex, *n* (%)					
Male	262 (32.6)	138 (33.5)	16 (22.2)	122 (35.9)	0.03
Female	542 (67.4)	274 (66.5)	56 (77.8)	218 (64.1)	
Ethnicity, *n* (%)					
White	714 (88.8)	371 (90.0)	69 (95.8)	302 (88.8)	0.07
Black	74 (9.2)	30 (7.3)	2 (2.8)	28 (8.2)	0.11
Hispanic	13 (1.6)	10 (2.4)	1 (1.4)	9 (2.6)	0.53
Other	3 (0.4)	1 (0.2)	0 (0)	1 (0.3)	0.65

PBA, pseudobulbar affect; SD, standard deviation.
[a]Residents with a neurological diagnosis and without psychosis.
[b]PBA symptoms based on Center for Neurologic Study-Lability Scale score ≥13.
[c]p-value comparing predisposed population with and without PBA symptoms.

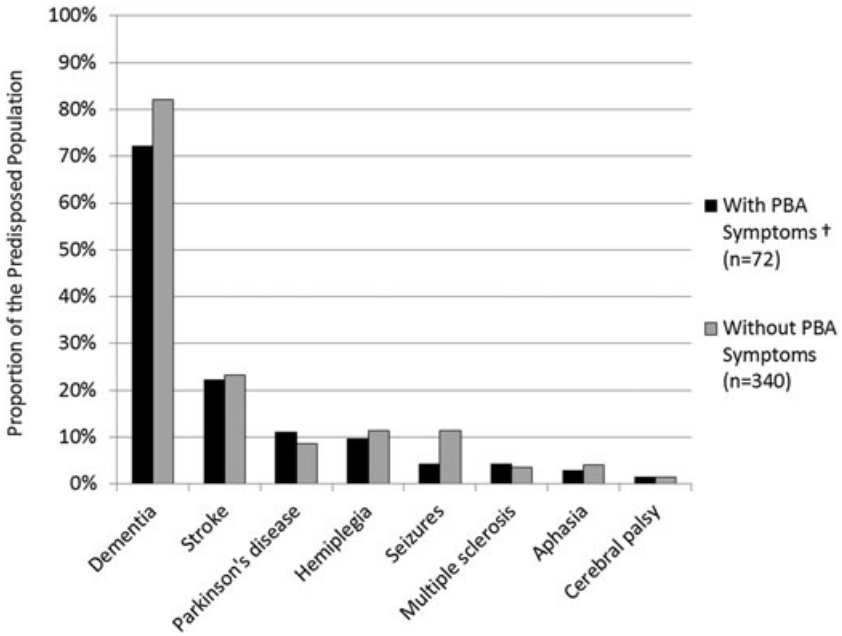


Figure 2 Neurological diagnoses within the predisposed population; residents with a neurological diagnosis and no evidence of psychosis, delirium, or disruptive behavior. †Presence of PBA symptoms defined based on CNS-LS score ≥13. CNS-LS, Center for Neurologic Study-Lability Scale; PBA, pseudobulbar affect.

In the predisposed population, 72% of the residents with PBA symptoms (CNS-LS score≥13) had a positive response for at least one item from the diagnostic evaluation checklist, compared with 6% of residents without PBA symptoms. The mean CNS-LS in those with at least one checklist item was 15, versus 8 in those with no checklist items.

Mean BIMS scores for residents with and without PBA symptoms were similar in the predisposed population (7.4 vs. 8.1, respectively, $p = 0.33$) and indicated moderate cognitive impairment in both groups.

In the predisposed population, those with PBA symptoms were more likely to have a documented mood disorder, although statistical significance was not reached for all outcomes. The most common mood diagnosis was depression (PBA 65.3% vs. no PBA 57.6%, $p = 0.232$), followed by anxiety (PBA

33.3% vs. no PBA 23.8%, $p = 0.093$; Figure 3). Furthermore, those with PBA symptoms were more likely to be using antipsychotics, as well as anxiolytics and antidepressants. Approximately twice as many residents with PBA symptoms (25.0%) were prescribed antipsychotic medications compared with residents without PBA symptoms (13.5%, $p = 0.015$; Figure 3). Results were similar for the use of anxiolytics (PBA 25.0% vs. no PBA 14.1%, $p = 0.022$). Antidepressant use was common in both groups but was numerically more frequent in those with PBA symptoms (62.5%) than in those without PBA symptoms (53.2%, $p = 0.151$).

Discussion

To our knowledge, this is the first study that investigates the prevalence of PBA symptoms in nursing home residents. In this cross-sectional study, almost one in 10 residents overall, and 17.5% of those with neurological disorders, had symptoms suggestive of PBA, based on a CNS-LS score ≥13. This prevalence estimate matches that from a previous study, which found that 9.1% of nursing home residents had documented crying and tearfulness (Zarowitz and O'Shea, 2013), but was lower than that observed in the PBA Registry Series (PRISM) study, which used the CNS-LS to screen for PBA symptoms in a predisposed population of 5290 outpatients diagnosed with one of six neurological conditions known to be associated with PBA (Brooks *et al.*, 2013). The PRISM registry found a PBA symptom prevalence of 36.7% using a CNS-LS score ≥13, including 29.3% of those with AD, 26.0% of those with PD, and 37.8% of those who suffered a stroke (Brooks *et al.*, 2013). This difference may be related to the population and sampling methodology. In the present study, we employed a convenience sample of nursing home residents with a neurological condition affecting the brain, while the PRISM study was a population-based registry study, conducted in the outpatient setting, including specific neurological conditions known to be associated with PBA. Furthermore, our study excluded residents with disruptive behaviors, although they may have also had PBA.

Those with a positive response to at least one item from the diagnostic evaluation checklist had an average CNS-LS score of 15 (vs. 8 in those with no positive responses to checklist items), suggesting that checklist items could be useful for indicating the presence of PBA symptoms. In addition, 72% of the residents with CNS-LS score ≥13 had a positive response for at least one checklist item, versus 6% of those with CNS-LS score <13. Overall, results indicate that although the checklist and CNS-LS are related, they may be measuring different aspects of PBA. This could be further explored in future studies.

Results of this study support previous findings, which link PBA symptoms in nursing home residents

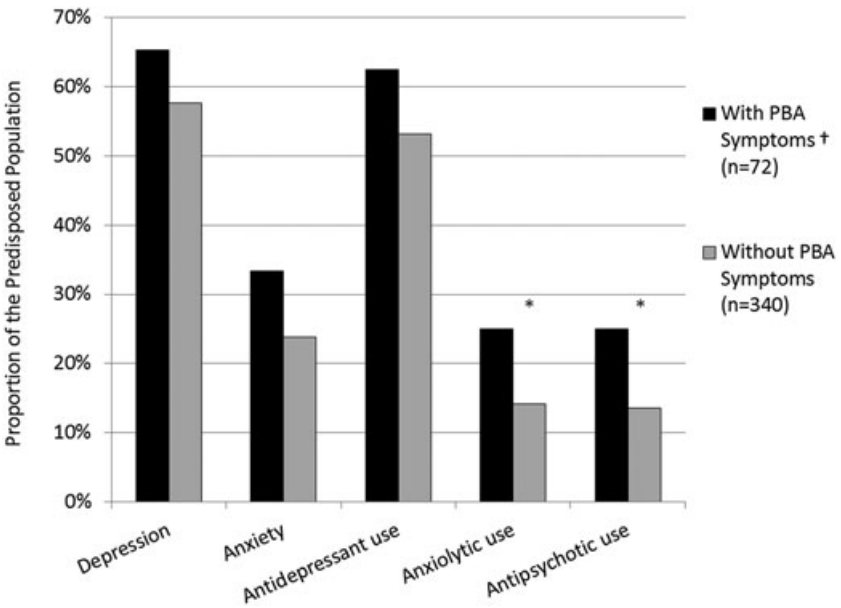


Figure 3 Psychiatric diagnoses and psychopharmacologic medication use within the predisposed population; residents with a neurological diagnosis and no evidence of psychosis, delirium, or disruptive behavior. †Presence of PBA symptoms defined based on CNS-LS score ≥13. *$p < 0.05$. CNS-LS, Center for Neurologic Study-Lability Scale; PBA, pseudobulbar affect.

to more frequent diagnoses of mood disorders and psychopharmacological medication use (Zarowitz and O'Shea, 2013). In the present study, individuals with symptoms of PBA had approximately twice the rate of antipsychotic medication use as those without PBA symptoms, despite having no diagnosis of psychosis. Antipsychotics can pose significant hazards, including increased mortality, to older adults, particularly those with dementia (Food and Drug Administration, 2005; Schneider *et al.*, 2005). Avoiding their use for disruptive behavior is recommended (American Geriatrics Society, 2012). This is particularly important in the case of PBA, where other treatment options are available.

The presence of PBA symptoms was also associated with numerically higher rates of anxiety and depression diagnoses, along with more frequent use of antidepressants and significantly higher use of anxiolytics. Although the difference in frequency of anxiety and depression diagnoses was not statistically different between PBA and non-PBA symptom groups, the potential for type II error cannot be ruled out, and this is a potential limitation of the study. Misdiagnosis of PBA as a mood disorder, particularly depression, may contribute to the higher frequency of depression diagnosis and antidepressant use, although mood disorders can be comorbid with PBA (Arciniegas and Lauterbach, 2005). While many clinicians associate crying with depression, a study by Green and colleagues found that prominent criers were far more likely to have a neurological condition than a psychiatric condition (Green *et al.*, 1987). Raising awareness of the neurological causes of crying, such as PBA, could facilitate effective treatment. The use of antidepressants and anxiolytics for treatment of PBA is not adequately supported by the literature. Published placebo-controlled trials employed small sample sizes and relied on unvalidated outcome measures (Hackett *et al.*, 2010; Miller *et al.*, 2011; Pioro, 2011; Ahmed and Simmons, 2013).

Because this study combined a large cross-sectional survey with a retrospective chart review, it allowed us to screen for PBA symptoms, estimate symptom prevalence (using the survey), and then investigate real-world treatment patterns and clinical correlates of PBA symptoms (using the chart review). Little was previously known about the prevalence of PBA symptoms in nursing home residents or its relationship with psychopharmacological medication use and mood diagnoses in this population, so this study provides valuable information. However, this study had several limitations. First, data regarding diagnoses and clinical/behavioral correlates were based on a retrospective chart review. The types of data available in charts are limited, and data are often recorded inconsistently. However, Medicare and Medicaid licensed facilities are required to record certain information about each resident on a regular basis as part of the MDS 3.0 assessment, a federally mandated program (Centers for Medicare and Medicaid Services, 2010). Therefore, chart reviews in this population are likely to yield more valid and reliable results than in populations where such requirements do not exist. The cross-sectional design of this study also limits our ability to make inferences regarding causality. This study employed a convenience sample in a single state, which may limit its generalizability to the population of US nursing home residents nationwide. An analysis was conducted comparing characteristics of nursing homes included in the study to other Medicare/Medicaid-certified nursing homes in the USA, using data from the Online Survey Certification and Reporting database (2010–2012). Results indicated that average characteristics of nursing homes in the study were generally similar to nursing homes nationwide, although there were significantly more patients with dementia in study nursing homes (Table 3). Finally, the sample size may have limited our ability to detect statistically significant differences between those

Table 3 Characteristics of nursing homes in the study and nationwide

	US nursing homes ($n = 15{,}986$)	Nursing homes in the study ($n = 9$)	p -value
Total number of residents	87.6	91.2	0.85
Total number of beds	108.2	110.6	0.91
Percent of residents on a Medicaid stay	59.8	70.4	0.18
Percent of residents on a Medicare stay	15.7	11.1	0.40
Percent of residents with dementia	47.1%	61.8%	0.02
Percent chain ownership	54.5%	77.8%	0.16
Percent for-profit	67.8%	77.8%	0.52
Percent not-for-profit	25.3%	22.2%	0.83
Number of regulatory deficiencies	6.03	6.33	0.86
Staff hours per resident-day	4.56	3.61	0.76
Registered nurse hours per resident-day	0.96	0.65	0.85

Data from the Online Survey Certification and Reporting database of Medicare/Medicaid-certified nursing homes in the USA, 2010–2012.

with and without PBA symptoms in some cases (e.g., for depression, anxiety, and antidepressant use).

Conclusion

In this cross-sectional study, the prevalence of PBA symptoms was 9.0% in all nursing home residents and 17.5% in those with a diagnosed neurological disorder affecting the brain. Increasing awareness and accurate diagnosis of PBA may help improve treatment and reduce the use of inappropriate medications, including antipsychotics.

Conflict of interest

C. Y. is employed by Avanir Pharmaceuticals, Inc.

Key points

- The prevalence of pseudobulbar affect (PBA) symptoms is approximately 9% among nursing home residents.
- The presence of PBA symptoms was associated with more frequent use of psychopharmacological medication, including antipsychotics.
- Increasing awareness and improving diagnostic accuracy of PBA may help to optimize management and reduce the use of inappropriate treatments.

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References

Ahmed A, Simmons Z. 2013. Pseudobulbar affect: prevalence and management. *Ther Clin Risk Manag* **9**: 483–489. DOI:10.2147/TCRM.S53906.

American Geriatrics Society 2012 Beers Criteria Update Expert Panel. 2012. American Geriatrics Society updated Beers Criteria for potentially inappropriate medication use in older adults. *J Am Geriatr Soc* **60**(4): 616–631.

Arciniegas DB, Lauterbach E. 2005. The differential diagnosis of pseudobulbar affect (PBA): distinguishing PBA among disorders of mood and affect. An expert review of clinical challenges in psychiatry and neurology (Proceedings of a Roundtable Meeting Convened to Discuss Pseudobulbar Affect). *CNS Spectr* 10[5 suppl]: 1-16.

Arciniegas DB, Topkoff J. 2000. The neuropsychiatry of pathologic affect: an approach to evaluation and treatment. *Semin Clin Neuropsychiatry* **5**(4): 290–306.

Brooks BR, Crumpacker D, Fellus J, Kantor D, Kaye RE. 2013. PRISM: a novel research tool to assess the prevalence of pseudobulbar affect symptoms across neurological conditions. *PLoS One* **8**(8): e72232.

Calvert T, Knapp P, House A. 1998. Psychological associations with emotionalism after stroke. *J Neurol Neurosurg Psychiatry* **65**(6): 928–929.

Centers for Medicare and Medicaid Services. 2010. Minimum Data Set, version 3.0 (MDS 3.0). Available at: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/NHQIQualityMeasures.html (accessed 11/05/14)

Chodosh J, Edelen MO, Buchanan JL, *et al*. 2008. Nursing home assessment of cognitive impairment: development and testing of a brief instrument of mental status. *J Am Geriatr Soc* **56**(11): 2069–2075.

Choi-Kwon S, Han K, Choi S, *et al*. 2012. Poststroke depression and emotional incontinence: factors related to acute and subacute stages. *Neurology* **78**(15): 1130–1137.

Colamonico J, Formella A, Bradley W. 2012. Pseudobulbar affect: burden of illness in the USA. *Adv Ther* **29**(9): 775–798.

Cummings JL, Arciniegas DB, Brooks BR, *et al*. 2006. Defining and diagnosing involuntary emotional expression disorder. *CNS Spectr* **11**(6): 1–7.

Food and Drug Administration. 2005. Public Health Advisory: death with antipsychotics in the elderly. Available at: http://www.fda.gov/drugs/drugsafety/postmarketdrugsafetyinformationforpatientsandproviders/ucm053171 (accessed 5/15/15)

Fort T. 2010. National Stroke Association survey on pseudobulbar affect in stroke survivors. Available at: http://support.stroke.org/site/News2?page=NewsArticle&id=9577 (accessed 5/15/15)

Green RL, McAllister TW, Bernat JL. 1987. A study of crying in medically and surgically hospitalized patients. *Am J Psychiatry* **144**(4): 442–447.

Hackett ML, Yang M, Anderson CS, Horrocks JA, House A. 2010. Pharmaceutical interventions for emotionalism after stroke. *Cochrane Database Syst Rev* (2): CD003690.

House A, Dennis M, Molyneux A, Warlow C, Hawton K. 1989. Emotionalism after stroke. *BMJ* **298**(6679): 991–994.

Kim JS, Choi-Kwon S. 2000. Poststroke depression and emotional incontinence: correlation with lesion location. *Neurology* **54**(9): 1805–1810.

Kim JS, Choi S, Kwon SU, Seo YS. 2002. Inability to control anger or aggression after stroke. *Neurology* **58**(7): 1106–1108.

Lopez OL, Becker JT, Sweet RA, *et al*. 2003. Psychiatric symptoms vary with the severity of dementia in probable Alzheimer's disease. *J Neuropsychiatry Clin Neurosci* **15**(3): 346–353.

Lövheim H, Sandman PO, Kallin K, Karlsson S, Gustafson Y. 2006. Relationship between antipsychotic drug use and behavioral and psychological symptoms of dementia in old people with cognitive impairment living in geriatric care. *Int Psychogeriatr* **18**(4): 713–726.

Miller A, Pratt H, Schiffer RB. 2011. Pseudobulbar affect: the spectrum of clinical presentations, etiologies and treatments. *Expert Rev Neurother* **11**(7): 1077–1088.

Moore SR, Gresham LS, Bromberg MB, Kasarkis EJ, Smith RA. 1997. A self report measure of affective lability. *J Neurol Neurosurg Psychiatry* **63**(1): 89–93.

Morris PL, Robinson RG, Raphael B. 1993. Emotional lability after stroke. *Aust N Z J Psychiatry* **27**(4): 601–605.

Parvizi J, Coburn KL, Shillcutt SD, *et al*. 2009. Neuroanatomy of pathological laughing and crying: a report of the American Neuropsychiatric Association Committee on Research. *J Neuropsychiatry Clin Neurosci* **21**(1): 75–87.

Petracca GM, Jorge RE, Ación L, Weintraub D, Robinson RG. 2009. Frequency and correlates of involuntary emotional expression disorder in Parkinson's disease. *J Neuropsychiatry Clin Neurosci* **21**(4): 406–412.

Phuong L, Garg S, Duda JE, Stern MB, Weintraub D. 2009. Involuntary emotional expression disorder (IEED) in Parkinson's disease. *Parkinsonism Relat Disord* **15**(7): 511–515.

Pioro EP. 2011. Current concepts in the pharmacotherapy of pseudobulbar affect. *Drugs* **71**(9): 1193–1207.

Saliba D, Buchanan J, Edelen MO, *et al*. 2012. MDS 3.0: brief interview for mental status. *J Am Med Dir Assoc* **13**(7): 611–617.

Schiffer R, Pope LE. 2005. Review of pseudobulbar affect including a novel and potential therapy. *J Neuropsychiatry Clin Neurosci* **17**(4): 447–454.

Schneider LS, Dagerman KS, Insel P. 2005. Risk of death with atypical antipsychotic drug treatment for dementia: meta-analysis of randomized placebo-controlled trials. *JAMA* **294**: 1934–1943.

Shaibani AT, Sabbagh MN, Doody R. 1994. Laughter and crying in neurological disorders. *Neuropsychiatry* **7**: 243–250.

Siddiqui MS, Fernandez HH, Garvan CW, *et al*. 2009. Inappropriate crying and laughing in Parkinson disease and movement disorders. *World J Biol Psychiatry* **10**(3): 234–240.

Smith RA, Berg JE, Pope LE, *et al*. 2004. Validation of the CNS emotional lability scale for pseudobulbar affect (pathological laughing and crying) in multiple sclerosis patients. *Mult Scler* **10**(6): 679–685.

Starkstein SE, Migliorelli R, Tesón A, *et al*. 1995. Prevalence and clinical correlates of pathological affective display in Alzheimer's disease. *J Neurol Neurosurg Psychiatry* **59**(1): 55–60.

Stefanacci RG, Arnicar R, Clark TR, *et al*. 2014. Improving the management of disruptive behavior and reducing antipsychotic medications in nursing facility residents. *Consult Pharm* **29**(12): 797–812.

Strowd RE, Cartwright MS, Okun MS, Haq I, Siddiqui MS. 2010. Pseudobulbar affect: prevalence and quality of life impact in movement disorders. *J Neurol* **257**(8): 1382–1387.

Tang WK, Chan SS, Chiu HF, *et al*. 2004. Emotional incontinence in Chinese stroke patients—diagnosis, frequency, and clinical and radiological correlates. *J Neurol* **251**(7): 865–869.

Tang WK, Chen Y, Lam WW, *et al*. 2009. Emotional incontinence and executive function in ischemic stroke: a case-controlled study. *J Int Neuropsychol Soc* **15** (1): 62–68.

Work SS, Colamonico JA, Bradley WG, Kaye RE. 2011. Pseudobulbar affect: an under-recognized and under-treated neurological disorder. *Adv Ther* **28**(7): 586–601.

Wortzel HS, Oster TJ, Anderson CA, Arciniegas DB. 2008. Pathological laughing and crying: epidemiology, pathophysiology and treatment. *CNS Drugs* **22**(7): 531–545.

Zarowitz BJ, O'Shea T. 2013. Clinical, behavioral, and treatment differences in nursing facility residents with dementia, with and without pseudobulbar affect symptomatology. *Consult Pharm* **28**(11): 713–722.

