The Gerontologist
Vol. 48, No. 6, 721–731

Factors Associated With Aggressive Behavior Among Nursing Home Residents With Dementia

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Purpose: In an attempt to more thoroughly describe aggressive behavior in nursing home residents with dementia, we examined background and proximal factors as guided by the Need-Driven Dementia-Compromised Behavior model. ***Design and Methods:*** We used a multivariate cross-sectional survey with repeated measures; participants resided in nine randomly selected nursing homes within four midwestern counties. The Minimum Data Set (with verification by caregivers) identified participants. We used a disproportionate probability sample of 107 participants (51% with a history of aggressive behavior) to ensure variability. Videotaped care events included four of direct care (shower baths, meals, dressing, and undressing) and two of non-direct care (two randomly selected 20-minute time periods in the afternoon and evening). The majority of participants (75%) received three shower baths, for a total of 282 videotaped baths. ***Results:*** Because the shower bath was the only care event significantly related to aggressive behavior ($F = 6.9$, $p < .001$), only those data are presented. Multilevel statistical modeling identified background factors (gender, mental status score, and lifelong history of less agreeableness) and a proximal factor (amount of nighttime sleep) as significant predictors ($p < .05$) of aggressive behavior during the shower bath. We found significant correlations between aggressive behavior and negative subject affect ($r = .27$) during the bath, and aggressive behavior and lifetime agreeableness level ($r = -.192$). We also found significant correlations between mental status and the amount of education ($r = .212$), and between negative caregiver affect and negative participant affect ($r = .321$). ***Implications:*** We identified three background and one proximal factor as significant risk factors for aggressive behavior in dementia. Data identify not only those persons most at risk for aggressive behavior during care, but also the care event most associated with aggressive behavior. Together these data inform both caregiving for persons with dementia as well as the design of intervention studies for aggressive behavior in dementia.

Key Words: Aggression in dementia, Need-Driven Dementia-Compromised Behavior (NDB) model of dementia care, Nursing home care

Aggressive behavior (AB) in persons with dementia is defined historically as destructive actions directed toward persons, objects, or self; AB is most commonly directed toward caregivers (Cohen-Mansfield, Marx, & Rosenthal, 1989; Ryden,

This study was one of three in an Interactive Research Project Grant (IRPG) funded by the National Institute of Nursing Research and the National Institute on Aging. This study was supported by IRPG RO1-NRO4568 (Aggression: Background and Proximal Factors; A. Whall, Principal Investigator). The other two studies within this group were IRPG R01-NR04569 (Wandering: Background and Proximal Factors; D. Algase, Principal Investigator) and IRPG R01-NR04570 (Problematic Vocalizations: Background and Proximal Factors; C. Beck, Principal Investigator). We wish to acknowledge the Need-Driven Dementia-Compromised Behavior Collaborative Research Group and the statistical consultation of Cathy Antonakos, PhD. The joint work of all these individuals and groups made this study and the IRPG possible.

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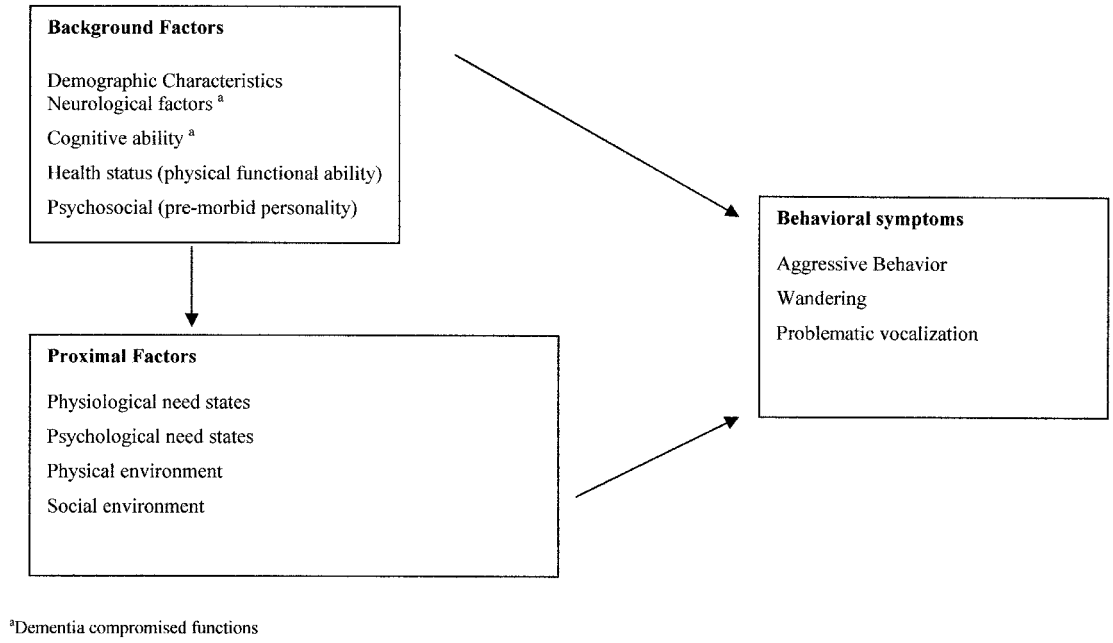

Figure 1. The Need-Driven Dementia-Compromised Behavior (NDB) model.

Bossenmaier, & McLachlan, 1991). Aggression has been identified as one of the most challenging aspects of such care (Leonard, Tinetti, Allore, & Drickamer, 2006; Sloane et al., 2004).

AB negatively affects the quality of life for both persons with dementia as well as their caregivers, and it contributes greatly to caregiver burden and burnout (Talerico, Evans, & Strumpf, 2002). Recent investigations concerning AB in dementia have addressed the following: techniques to decrease aggression and other problematic aspects of dementia during bathing (Sloane et al., 2004); correlates of aggression among nursing home residents with dementia (Boustani et al., 2005; Eustace et al., 2001; Talerico et al.); and associations between AB, depression, delusions, hallucinations, and constipation in this population (Leonard et al., 2006). These studies and others have added significantly to the body of knowledge concerning aggression in dementia, addressing the problem from a multiplicity of viewpoints and a variety of techniques.

Our study is guided by the Need-Driven Dementia-Compromised Behavior model (NDB model; Algase et al., 1996). In part the NDB model is built on findings from earlier studies, including those by Swearer, Drachman, O'Donnell, and Mitchell (1988); Teri, Larson, and Reifler (1988); Cohen-Mansfield and associates (1989); Evans and colleagues (1989); Meddaugh (1991); Beck, Rossley, and Baldwin (1991); Ryden and associates (1991); Werley, Devine, Zorn, Ryan, and Westra (1991); and Burgener, Jirovec, Murrell, & Barton (1992).

Subsequent studies examining aspects of the NDB model include those by Kolanowski, Strand, and Whall (1997); Whall (1999, 2002); Kolanowski, Buettner, Costa, and Litaker (2001); Kolanowski, Litaker, and Bauman (2002, 2005); Algase, Whall, and Beck (2003); Kolanowski, Algase, Whall, Richards, and Beck (2004); Kolanowski and Litaker (2006); Yao and Algase (2006); Algase and colleagues (2007); Kovach and colleagues (2004); and Kim and Whall (2006).

Purpose of the Study

Our purpose in this study was to more thoroughly describe the occurrence of AB in dementia, using sets of background factors (e.g., cognitive status and personality characteristics of persons with dementia) as well as sets of proximal factors (e.g., characteristics of physical and social environments) as found in the NDB model (see Figure 1). We sought to provide more specific data for the design of AB intervention studies, as well as for the design of better care for persons with AB in dementia. Our research questions were as follows. First, what background factors (demographic characteristics, dementia-compromised functions, health status, and psychosocial states) best predict which persons with dementia will display AB? Second, what proximal factors (physiological and psychosocial need states; physical and social environmental conditions) best predict the circumstances under which AB occurs?

Methods

Design

We used a multivariate cross-sectional descriptive survey of background factors with repeated measures of proximal factors. We recruited participants from nine randomly selected nursing homes found

within four contiguous counties surrounding a major midwestern university. The nursing homes we selected were small to medium size, with fewer than 103 certified Medicare or Medicaid beds.

Sample and Power Analysis

To ensure sufficient variance, we obtained a disproportionate probability sample. In each randomly selected nursing home, we sorted participants who met all other criteria into two groups: those with a verified history of AB, and those without such history. This constituted the sample in each home. We identified the AB history by using the Minimum Data Set (MDS) required for licensed nursing homes, and this history was also verified by a caregiver who directly cared for the resident during the 4 weeks prior to inclusion in the study. From this process, we ascertained that 50.5% of the participants had a past history of AB, and 49.5% did not have a past history of AB. We also randomly selected the shower baths to be videotaped. Fewer than 2% of eligible participants or their designated relatives refused participation. Once the study began, there was an attrition rate of 10% because of (in order of magnitude) the occurrence of an acute illness, the revocation of family consent, or the death of the participant.

Participant inclusion criteria were as follows: a diagnosis of Alzheimer's disease or vascular dementia that met the criteria for these conditions as found in the revised fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 1995); a Mini-Mental Status Examination (MMSE) score of less than 24 (Folstein, Folstein, & McHugh, 1975); and a willing family informant who met the "closeness criteria" to the subject (e.g., child or spouse). For any participants receiving psychotropic medication, stability in dosage was required for at least 1 month prior to the study and the dosage had to remain at this level throughout baseline and final observation. Participants were further required to have been in continuous residence at the nursing home for at least 6 months prior to the study; free from acute illness; and not physically restrained in any manner.

The design of the study has baths nested within persons. Using PASS (Hintze, 2002) software, we conducted a power analysis to determine if the power for the planned analysis was sufficient. A conservative approach to power analysis given this design is to treat the person ($N = 107$) as the unit of analysis. This is conservative because it is equivalent to assuming that the intraclass correlation (ICC) was the maximum possible value (1.0).

Because the dependent variable is dichotomous and analyzed by a multilevel variation of logistic regression, we conducted a power analysis for logistic regression taking that conservative approach. The effect size we sought was a difference of 30% between rates of AB in the two subgroups, defined by a predictor variable (40% vs 70%) with a correlation of the 10 other covariates, with the behavior explaining 20% of the variance. Power was 80.5% for this analysis (Hintze, 2002). This power analysis, completed prior to multilevel modeling, indicated that we could include up to 11 predictor variables while maintaining such power. We also examined variables for significance with AB by means of first-order t tests and correlations.

Procedure

The Institutional Review Boards of the university and nursing homes granted permission to conduct the study. The resident's "responsible party" (identified in nursing home documents) provided written consent. Before each observation or videotaping, we queried participants for assent. If the participant appeared to or definitely declined participation at that time (as verified by a caregiver), we made a second attempt within 15 minutes. If the second response also was negative, we considered this nonassent to participate and did not observe or videotape at that time.

Chart reviews, physical and neuropsychological examinations, and interviews with family informants and nursing home personnel provided data on background factors. For proximal factors, we completed videotaping of four direct care events: (a) shower baths, (b) meals, (c) dressing, and (d) undressing procedures. For nondirect care events (e.g., sitting in the community room), we completed videotapes of two randomly selected time periods: (a) one 20-minute period between the hours of 1 p.m. and 3 p.m., and (b) one 20-minute period between the hours of 5 p.m. and 7 p.m. If meals occurred during these randomly selected nondirect care times, the videotaping excluded the meal; meal times were thus randomly and separately selected for videotaping.

We observed up to three randomly selected shower baths during a 2- to 3-week time period for the 107 participants. Each shower bath was separated by at least 48 hours and lasted on average 13 minutes ($SD = 6.8$). The majority of the baths were conducted from 7 a.m. to 12 noon, with less than 10% occurring outside this time frame, primarily as a result of special family requests. To provide privacy during shower bath videotaping, we had the participants draped with a large bath towel secured at the back of the neck during the entire shower. Of the 107 participants, all completed the first bath, 95 completed a second bath, and 80 completed a third bath, with 75% of the sample receiving three baths and providing a total of 282 videotaped baths.

We monitored the physical and social environments during the shower bath, including light, sound, temperature, and humidity levels. The social environment data included nurse aide behavior during the shower bath (e.g., eye contact, banter, and demeanor) as obtained from videotapes. From staffing records we obtained staff mix and stability

data that occurred during the time of the shower baths, and nursing home administrators verified these data.

During all observations we used a naturalistic approach; that is, we followed the participants' usual routine in the nursing home rather than impose a different structure upon their care. Baths and meal times, for example, were videotaped at their usual time with care given in the usual manner by the usual nurse aide. Because the nondirect care observations were not based on a direct care event, we randomly selected two 20-minute observation periods. No more than two care events were videotaped on any one day.

We completed the videotapes with a Sony DVD CAM digital video camera that was positioned obliquely (out of a participant's direct visual field) during all taped events. We had the videotapes converted to digital files that trained raters, blinded to study hypotheses, coded by using the Noldus Observer 5.0 (Noldus Information Technology, 2003). We transferred the output data to SPSS Version 12 for analysis (SPSS Inc., 2003). The video camera was fastened to the top of a moveable tripod and was operated by a trained research technician who remained present during all videotaping to ensure accuracy.

We addressed the issue of videotape rater training and the maintenance of consistency by using 12 raters trained in a stepwise process. A 3-hour orientation program introduced the Noldus Observer. Raters practiced coding on sample tapes until their level of mastery reached or surpassed the .90 level. To check ongoing accuracy, we randomly selected raters to code a ''gold standard'' videotape on a monthly basis throughout the study to ensure 95% or above agreement with the gold standard tapes. We also maintained a laboratory log and reviewed it daily to clarify and refine any coding issues or decisions.

During all coding sessions, we sequestered raters in a sound-controlled room, with separate stations and individual sets of headphones and computers. We monitored these raters for compliance with rating rules (e.g., no food, radios, CD players, or cell phones present); raters were also required to take regular breaks so as to maintain a consistent focus.

The Dependent Measure

The AB subscale of the Cohen–Mansfield Agitation Inventory, or CMAI, was the dependent measure we used to provide behavioral data. The CMAI is one of the most frequently used assessment scales that rate behavioral symptoms of dementia (Rojas-Fernandez, Lanctot, Allen, & MacKnight, 2001; Stoppe, Brandt & Staedt, 1999). The AB subscale of the CMAI includes nine items (with accompanying definitions) for spitting, cursing or displaying verbal aggression, hitting, kicking, grabbing onto people or things inappropriately, pushing, biting, scratching, and tearing things or destroying property.

In a study of 408 nursing home residents, a factor analysis of the CMAI yielded three syndromes of behavior; interrater agreement rates averaged .92 (Cohen-Mansfield et al., 1989). In 1991, Chrisman, Tabar, Whall, and Booth modified the original 29-item CMAI for direct observation and found that ''episodes'' of AB, rather than single acts, occurred in persons with dementia. An episode was defined as the occurrence of one AB not interrupted by any other behavior. This 1991 study found that interrater reliabilities using the modified CMAI ranged from .72 to .81 (N = 22); in a later study of CMAI interrater reliability, .90 was reached or exceeded (Whall, Black, Yankou, Groh, Kupferschmid, Foster & Little, 1999.) Total scores for the dependent measure in the current study were summed episodes of AB behavior as defined with the modified CMAI AB subscale.

Independent Measures

Demographic Data.—We obtained the data from a certified nurse practitioner who used nursing home record reviews. We later verified these data by means of interviews with the ''relative of record,'' the person designated in nursing home records as having the most complete information regarding participants. We initially identified the history of AB by using both current and past indicators from MDS Section E.4, Item b (i.e., verbally abusive physical symptoms) and Item c (i.e., physically abusive physical symptoms). We further verified these data by using input from the direct caregivers. We obtained data on educational level (number of years of education) and gender (as a categorical predictor of AB) from chart reviews, which we later verified with the relatives of record.

Cognitive Ability.—We addressed cognitive ability in three ways: we used the total MMSE score (Anthony, LeResche, Niaz, von Korff, & Folstein, 1982; Folstein et al., 1975; Foreman, 1987) as administered by a certified nurse practitioner; we used the cognitive assessment history (including past MMSE scores) as found in nursing home records; and we used input from current caregivers most familiar with the participant. We had the MMSE administered to the participants approximately 2 weeks before all other data were collected.

The MMSE is one of the most widely used tools to screen for cognitive impairment (Lancu & Olmer, 2006). The MMSE contains 30 items of orientation, registration, short-term memory, attention, concentration, language, and constructive capacity. The total score ranges from 0 to 30, and it is generally classified into four ranges: 24–30 (no cognitive impairment), 18–23 (mild cognitive impairment), 10–17 (moderate cognitive impairment) and less

than 10 (severe cognitive impairment) (see Tombaugh & McIntyre, 1992). The MMSE has demonstrated high levels of sensitivity to severe cognitive impairment in tests of construct validity. Correlations with the Blessed Information–Memory–Concentration test measuring cognitive functioning ranged from .70 to .90. The levels of the reliability of the MMSE range between .77 and .99 (Foreman, 1987). Cronbach's alpha for internal consistency of the MMSE in our study was $\alpha = .91$.

After the participant made two attempts to complete the MMSE, if the answers the participant provided were not "correct," then we scored the MMSE as zero. We verified all responses with the caregiver most familiar with the participant.

General Health State.—We measured the general state of health of the participant by using the Cumulative Illness Rating Scale for Geriatrics (CIRS-G), with which we could assess each participant's health status (Miller & Towers, 1991). The CIRS-G assesses 14 physical impairment groups in body system categories in which older adults commonly experience problems. The validity of the CIRS-G for usage in geriatric populations was supported by Parmelee, Thuras, Katz, and Lawton (1995) through associations with mortality, acute hospitalizations, medication usage, laboratory findings, and disability. Validity was established by comparing CIRS scores with mortality, hospitalization, medication usage, and laboratory findings in a study of 439 institutionalized elders. A certified nurse practitioner, trained to use the CIRS-G, assessed each participant's health state. Although the CIRS-G produced a low Cronbach alpha ($\alpha = .32$), we included it in the analysis because of the relationships between physical conditions (e.g., painful arthritis) and AB.

Motor Ability.—We derived motor ability from the participant's current mean scores on the Activities of Daily Living section of the MDS, version 2.0, Section G, Items a–f. These items address overall motor ability, including transfers, walking, and the like. The ADL section of the MDS is one of the most frequently used instruments to measure nursing home residents' physical functioning (Lawton et al., 1998; Casten, Lawton, Parmelee, & Kleban, 1998) tested interrater reliability and correlations between raters and activities of daily living items of the MDS are reported as 0.99 and kappa is reported as 0.61. Reliabilities for this section in the MDS are reported at .92 and .84 when completed by facility and research staff. In our study, the scores ranged from 0 (no support required) to 4 (total dependence) and the internal consistency (Cronbach's alpha) was .93.

Psychosocial State.—We assessed the psychological state relating to past personality by using the NEO Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992). This 60-item Likert-type self-report (adopted for family informant use) described the participant's predementia personality characteristics. The NEO-FFI addresses five adult personality domains: neuroticism, extraversion, openness, agreeableness, and conscientiousness. A first-degree relative (usually an adult child or spouse), identified through the nursing home records as the person with the most knowledge of the participant as an adult, completed the NEO-FFI by means of a telephone interview. The family members completing the NEO consisted of 33% daughters, 27% sons, 9% spouses, 4% grandchildren, and the remainder close family friends.

The interviewer asked the family informant to rate his or her family member's premorbid personality, as it was 10 years before the onset of dementia. Informants were required to have had at least monthly contact with participants for at least 3 years before dementia onset.

Several studies have found that close family members are accurate raters of a family member's personality. In a subsample of the Baltimore Longitudinal Study on Aging, researchers found highly stable correlations between 139 self-ratings and spousal ratings for the personality traits of neuroticism, extraversion, and openness. Further, median concurrent and cross-lagged correlations of self-ratings and spousal ratings taken in 1980 and 1986 were significant (Costa & McCrae, 1992).

In a more recent study, Archer, Brown, Reeves, Boothby, Nicholas, and Lovestone (2006) reported on interinformant and intrainformant reliability of the NEO-FFI. Premorbid personality was rated retrospectively by close family members or others with regular contact. Two different informants rated 105 persons with Alzheimer's disease; 30 persons were rated by the same informant at two separate points that were 1 year apart. Interinformant reliability ranged from good to excellent (ICC = .68–.78) and intrainformant reliability was found to be excellent (ICC = .84–.96). In our study, we converted neuroticism, extraversion, agreeableness, and conscientiousness scores to T scores and used them in the multilevel analysis.

Behavioral Response to Stress Scale.—We developed a Behavioral Response to Stress Scale (BRSS) for our studies by expanding an interview guide used to evaluate motoric responses to stress in persons with dementia (Monsour, 1980). This expansion included subscales for verbal, passive, and aggressive behavior (Colling et al., 2004). For this study, we interviewed the NEO informants for the BRSS. Informants rated the participant's response to stressful events prior to dementia onset on a 5-point Likert scale for six aggression, four negative verbalization, and five motoric items. In the multilevel modeling, we used only the BRSS Aggression subscale score. We did

not use the two other categories (i.e., verbal and passive behavior) because these items are not sufficiently developed. The reliability of BRSS aggressiveness (Cronbach's alpha) in our study was $\alpha = .79$.

Physiological Needs.—We assessed each participant's physiological needs by using an investigator-developed physiological need state assessment. This investigator-developed instrument combines direct questioning (participant data) and objective data (e.g., observations of food or fluid intake) into a composite rating on six physiologic states: hunger, thirst, urination, bowel movement, pain, and discomfort. Participants were asked to rate, for example, how hungry they were on a 4-point scale (none, little, somewhat, a lot). In our study the physiological need state assessment was administered following the participant's shower bath; each participant's responses were verified by the primary caregiver completing the shower bath. Although the instrument has considerable face validity, missing data for 25% of the cases precluded inclusion in the major analysis.

Sleep Disturbance.—We addressed sleep disturbance by using the Actigraph, an omnidirectional accelerometer about the size and weight of a large watch (ActiGraph LLC, Pensacola, FL). This measure of rest–activity is a proxy for sleep disturbance rather than a direct measure. Worn on the nondominant wrist, it assesses movement frequency and duration of movement indicative of sleep. Participants wore an actigraph on their wrist for five 24-hour periods. The actigraph contains an electric cell that continuously records participant movement. At the end of the data-collection period, we downloaded and analyzed data by using a computerized algorithm to score minutes of wake and sleep based on the average number of patient movements per 1-minute epoch. For this study, we defined nighttime as the period from 6 p.m. to 6 a.m. We averaged nighttime sleep across five nights. We used the total amount of nighttime sleep (in minutes) in our multilevel analyses.

Psychosocial State.—We assessed psychosocial state by means of the revised 35-item Observable Displays of Affect Scale (Vogelpohl & Beck, 1997) that measured the participant's affect. The Observable Displays of Affect Scale (Vogelpohl & Beck, 1997) was developed for persons with dementia to rate both their positive and negative affect in three categories: facial display, vocalizations, and body movement. Interrater reliability for the subscales calculated by Beck and colleagues has ranged from .46 to .80. Test–retest reliability for the subscales ranged from .97 to 1.00. Content validity was established by a panel of experts in gerontological nursing, who averaged 17.8 years in the field. Trained raters scored videotapes of shower bath events by using Noldus Observer 5.0 to count the occurrence of these behaviors. We used mean negative scores for these three subscales in our multilevel analyses.

Physical Environment.—We assessed the physical environment, that is, light, sound, temperature, and humidity, at 10-minute intervals during the shower bath. The instruments we used were a digital light meter (Pascoe Scientific, Roseville, CA), which yields a light exposure score, a sound level meter (Sound Level Meter L-M 9600, Quest Technologies, Oconomowoc, WI), providing a digital display of sound level, and a thermohydrometer (Indoor Humidity Gauge Thermometer, RadioShack, Fort Worth, TX) that provides temperature range and relative humidity levels. We averaged scores across the shower bath observation. We tested these instruments every 3 months to ensure technical accuracy.

Social Environment.—We measured the social environment by using the Staff Familiarity score (an investigator-designed instrument) for the direct caregiver. The literature suggests that AB is related to caregiver familiarity with persons with dementia (Spore, Smyer, & Cohn, 1991; Whall et al., 1999). Direct caregivers were interviewed to determine "how well" and "how long" they knew the person with dementia, as well as how often they provided care. The Staff Familiarity instrument reliabilities were .62 for direct caregivers and .60 for charge nurses. We used the mean familiarity scores for direct caregivers in our analyses.

Caregiver Behavior.—We assessed caregiver behavior by using Burgener's Modified Interaction Behavior Measure (MIBM; Burgener et al., 1992; Burgener & Twigg, 2002). The areas we assessed are as follows: positive or negative caregiver facial expressions (demeanor), verbal expressions (banter), and body movements, including eye contact. Reliabilities for the MIBM ranged from .81 to .93 (alpha) and 56 to .83 (interrater). In a pilot rating of videotapes using the MIBM, our raters were able to reach 79% agreement in two rating sessions. We used mean negative caregiver behavior scores in our multilevel analysis, as first-order analyses indicated only the negative scores (vs positive scores) were significantly related ($r = .321$) to AB.

Reliability of instruments.—The reliability of instruments in our study using Cronbach's alpha was MMSE, .91 and motor ability (MDS Activities of Daily Living Items a–f), .83. For the NEO-FFI, the reliability was as follows: neuroticism, .79; extraversion, .84; openness, .65; agreeableness, .89; and conscientiousness, .90. For the BRSS, the reliability was aggressiveness, .79; negative verbalization .72; and Motor "busyness," .85. For staff familiarity the reliability was .62 for direct caregivers and .60 for

Table 1. Demographic Characteristics of the Sample

Variables	*n*	%	*M*	*SD*
Age (years)			87.1	6.5
<85	35	32.7		
>85	72	67.3		
Cognitive ability (MMSE)			8.6	6.8
Length of stay (months)			25.4	27.8
Gender				
Male	13	12.1		
Female	94	87.9		
Race				
Caucasian	101	94.4		
African American	6	5.6		
History of AB				
Yes	54	50.5		
No	53	49.5		
Education				
Partial college or higher	27	25.2		
Partial high school of graduate	56	52.3		
Junior high school or lower	24	22.4		

Note: For the sample, $N = 107$. MMSE = Mini-Mental State Examination; AB = aggressive behavior.

charge nurses. Although the 14-item CIRS-G (for general health status) produced a low Cronbach alpha ($\alpha = .32$), we included it in our analyses because physiologic states have been related to AB (Leonard et al., 2006).

Results

An analysis of variance with Scheffe post hoc analysis revealed the shower bath as the only care event (out of the four direct care and two nondirect care events) significantly related to AB, with $F = 6.9$ ($p < .001$). Thus, our data for the Results and Discussion sections are derived from the 282 videotaped shower baths of the 107 participants.

The demographic characteristics (see Table 1) of this sample revealed a somewhat higher educational level, given that 88% of the sample were women with an average birth date of 1913 (U.S. Census Bureau, 2005). That is, 25% of the sample had partial to full college educations, and 52% had partial to full high school educations, whereas 22% had junior high school or lower levels of education. Although the sample was derived primarily from areas within or adjacent to small cities, these sites were also within a 45-minute drive time to a major university; this may account for the somewhat higher educational level for women. This finding of a high education level for women is to some extent a limitation to generalization. The proportion of minority participants was congruent with census data for the target counties; however, the 12% male sample was a somewhat higher level than we found in our earlier studies (i.e., 5% to 7%).

Of the 282 videotaped showers, 103 (or 37%) showed some participant AB. Within this group, percentages for specific types of AB were as follows: 26% cursing or verbal aggression; 14% grabbing onto people or things inappropriately; 10% hitting; and 6% pushing. All other AB occurred in less than 5% of the videotapes.

Data Analyses

First-order *t* tests demonstrated a significant relationship between three factors and AB. These were as follows: participants' MMSE score and AB, past agreeableness and AB, and negative affect of participants during the bath and AB (See Table 2).

Table 2. *T* Tests for Selected Variables and Presence or Absence of AB

Variables	AB	*Mean*	*SD*	*t*	*p*
Education	No	3.9325	1.3160	−1.6210	0.108
	Yes	3.4717	1.5872		
MMSE	No	9.8881	6.6496	2.1240	0.036*
	Yes	7.1724	6.5374		
Comorbidity index	No	4.6667	1.5849	0.1520	0.8800
	Yes	4.6200	1.5894		
Past agreeableness	No	47.3645	12.8399	2.0040	0.048*
	Yes	42.3161	13.1784		
Past aggression	No	0.3939	0.4948	−0.7860	0.434
	Yes	0.4743	0.5637		
Nighttime sleep	No	263.6194	95.9108	−1.6050	0.112
	Yes	294.1689	100.8446		
Negative affect PWD	No	0.0759	0.0513	−2.8870	0.005**
	Yes	0.1066	0.0588		
Caregiver familiarity	No	41.7344	11.4752	−0.2470	0.805
	Yes	42.2163	8.6535		
Caregiver negativity	No	0.0727	0.0482	−1.9430	0.055
	Yes	0.0932	0.0594		

Notes: MMSE = Mini-Mental State Examination; AB = aggressive behavior; PWD = person with dementia.
*$p < .05$; **$p < .01$.

Table 3. Multilevel Regression Predicting AB in 282 Baths

Variable	Estimate	*SE*	*OR*	*p*
Background variables				
Male gender	−2.0415	0.9236	0.1298	0.0284*
Education	−0.1144	0.2295	0.8919	0.6188
MMSE	−0.1002	0.0497	0.9047	0.0453*
Comorbidity index	−0.0204	0.1928	0.9798	0.9160
Past agreeableness (NEO)	−0.0557	0.0210	0.9458	0.0087**
Past aggression (BRSS)	−0.0040	0.5652	0.9960	0.9943
Proximal variables				
Nighttime sleep	0.0071	0.0030	1.0071	0.0200*
Negative affect (ODAS)	7.5205	5.0510	1845.49	0.1384
Licensed–unlicensed staff	−0.8422	5.5550	0.4308	0.8797
Familiarity direct caregiver	−0.0317	0.0176	0.9688	0.0738
Negative caregiver behavior	6.5610	4.2912	706.98	0.1281

Notes: AB = aggressive behavior; MMSE = Mini-Mental State Examination; NEO = NEO Five Factor Inventory, which addresses neuroticism, extraversion, openness, agreeableness, and conscientiousness; BRSS = Behavioral Response to Stress Scale; ODAS = Observable Displays of Affect Scale.
*$p < .05$; **$p < .01$.

The analyses presented in Table 3 used a multilevel variation on logistic regression conducted with SAS software accounting for the nesting of baths within participants. Thus it accounted for combining multiple behavioral observations within participants. The power analysis was somewhat conservative to meet the same aim. Not knowing a priori what the ICC was, we assumed it was the maximum (1.0), which corresponded to treating each participant as the unit of analysis.

We conducted our multilevel analysis by using the SAS % glimmix macro to fit the generalized linear mixed model equivalent to a logistic regression model in which the dependent variables were dichotomous and observations (baths) were nested within participants (SAS Institute Inc., 2004). Because the power analysis indicated that up to 11 predictors could be used for multilevel modeling while still maintaining sufficient power, the predictors we selected were either those significantly related to AB in the first-order *t* tests or those judged important in the literature (e.g., gender and education). The 11 predictors we chose for the multilevel regression analysis were distributed across six background and five proximal factors. Our results revealed four significant (primarily background) predictors.

Correlations

None of the physical environment measures recorded during the shower bath (i.e., light, sound, temperature, and humidity) were significantly correlated with AB. Other correlations that met a $p < .05$ level of significance were negative participant affect and lifelong agreeableness scores ($r = -.192$), lifetime agreeableness and lifetime extraversion scores ($r = .354$), higher education and MMSE scores ($r = .212$), and ''negative caregiver behavior'' and ''negative participant affect'' scores ($r = .321$).

Discussion

The Results and Discussion sections concern only AB that occurred during the shower bath, because this was the only care event (of the six observed–videotaped events) in which AB was a significant occurrence. In this study we explored two major relationships: that certain background factors are risk factors for AB in dementia; and that certain proximal factors in the physical and social environment act as ''triggers'' to AB in dementia. The three background factors that significantly predicted the occurrence of AB in the shower bath were gender, stage of dementia (as indicated by the MMSE score), and past personality profile (as indicated by the NEO past agreeableness score). One proximal factor significantly predicted AB during the shower bath, and this was the total amount of nighttime sleep. Negative caregiver behavior and negative participant affect during the shower bath were also significantly correlated. Because we could not enter physiologic need data into the equation (insufficient data), this relationship remains unclear.

Although certain AB risk factors (e.g., gender and education) cannot be changed, taken together they can alert caregivers to ''persons at risk for AB.'' Early identification and ongoing monitoring of such at-risk persons for the onset of negative affect is an important caregiving activity. Our findings that negative caregiver banter and demeanor are also significantly related to AB during bathing are important to caregiver training and ongoing monitoring of at-risk patients. Burgener's early and continuing work (1992, 2002) supports this reciprocal negativity; combined with our findings, this reciprocity emphasizes the need for specialized training of caregivers for persons at risk for AB.

Relating our NEO findings to that of others, we found that a lifetime of nonagreeableness signifi-

cantly predicted AB, a finding consistent with the work of Costa and McCrae (1992) as well as Kolanowski and colleagues (1997). A number of studies using samples from the general population, as well as those of persons with dementia (Chatterjee, Strauss, Smyth, & Whitehouse, 1992; Dawson, Welsh-Bohmer, & Siegler, 2000; Siegler, Dawson, & Welsh, 1994; Siegler et al., 1991; Williams, Briggs, & Coleman, 1995), indicate that the trait of agreeableness is stable, and may even increase throughout adulthood. These findings suggest the importance of identifying persons at risk for AB and for addressing this finding in AB intervention studies.

In both cross-sectional and longitudinal studies, personality traits have shown little change after people reach the age of 30 years. These earlier findings have been supported by recent reports from the Baltimore Longitudinal Study of Aging: Hierarchical linear modeling analyses showed a gradual decline in neuroticism, stability in extraversion, decline in openness, increase in agreeableness, and increase in conscientiousness through old age (Terracciano, McCrae, Brant, & Costa, 2005). These findings inform late life care because cross-sectional studies show little (Chatterjee et al., 1992) or no change in agreeableness after the onset of dementia (Siegler, et al., 1991, 1994; Williams et al., 1995).

Our finding that lifetime nonagreeableness significantly predicted AB in dementia supports the findings of Archer and colleagues (2007) and of Hamel and colleagues (1990), but it differs from the findings of Low, Brodaty, and Draper (2002), who conducted a smaller study. Archer and colleagues found that premorbid agreeableness may influence aggression through psychological or biological pathways; individuals low on agreeableness prior to dementia may thus have a poorer response to the challenges of dementia (e.g., memory loss, functional impairments, and language deficits). Alternatively, changes occurring in dementia may result in disinhibition, and AB may displayed by persons with a lifetime tendency toward low agreeableness. Our findings suggest that the shower bath is an event that elicits both fear and confusion, especially when it is implemented in a hurried fashion. Taken together, our findings suggest that AB intervention studies address the interaction effects of specific background factors (e.g., neurological and past personality characteristics) in prevention and perseverance of AB in dementia. Although the cross-sectional nature of our data is a limitation of the predictive value of personality traits in persons with dementia, we measured AB during the shower bath, a direct care event likely to provoke defensiveness in persons with a premorbid disposition toward anger. This relationship was supported.

In terms of proximal factors, our data on unmet physical needs of persons with dementia (e.g., hunger) and its association with AB were insufficient for inclusion in our analyses. This relationship, however, is likely to extend the specifics of interventions for AB, especially in light of the findings of Leonard and associates (2006). Likewise, the measurement of the relationship between physical illness and AB must be more specifically addressed; modification of the CIRS-G is suggested.

We further examined our somewhat unusual finding that greater amounts of nighttime sleep significantly predicted AB during the shower bath. We found that both groups, that is, the group of individuals with AB and the group without AB, received fewer than 5 hours of nighttime sleep; the group with AB received 30 minutes more sleep per night than that without AB. A further analysis demonstrated that participants with AB were more likely to receive psychoactive drugs than those without AB, that is, $\chi^2 = (1)\ 5.172$, $p < .05$, suggesting a possible effect of these drugs upon increased nighttime sleep, but not upon AB display during caregiving (Kim & Whall, 2006). These findings also suggest the need to consider the role of psychotropic drugs more completely in the design of AB interventions.

The AB profile identified in this study presents necessary but not sufficient data for the design of AB interventions. Other types of knowledge continue to be needed. It is clear from our findings and that of others, however, that an algorithm predicting the onset and perseverance of AB in dementia is emerging. Our study identified primarily background factors important to this algorithm; a clearer explication of proximal factors is now needed (e.g., that regarding physiologic need states, effects of physical illness, and the role of psychotropic drugs on AB). Our multilevel study further clarified at-risk persons and their AB triggers. The comment of Kovach and colleagues, (2004), however, still applies: Effective interventions for troubling behaviors in dementia will require many more and much clearer specifications than has previously been thought.

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Received February 1, 2007
Accepted December 7, 2007
Decision Editor: William J. McAuley, PhD