The Relationships of Environment and Personal Characteristics to Agitated Behaviors in Nursing Home Residents With Dementia

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ABSTRACT

Objective: To explore the impact of personal attributes, environmental attributes, and the presentation of 9 categories of stimuli on agitation in nursing home residents with dementia.

Method: Participants in this randomized, controlled, observational cross-sectional study were 193 residents of 7 nursing homes, all with a diagnosis of dementia, for whom we obtained data pertaining to cognitive functioning (via the Mini-Mental State Examination), performance of activities of daily living (Minimum Data Set), and role-identity/activities of past interest (Self-Identity Questionnaire). Environmental attributes (eg, noise, lighting) and direct observations of agitation (primary outcome) were recorded via the Agitation Behavior Mapping Inventory. Engagement was measured using the Observational Measurement of Engagement. Both agitation and engagement were assessed for each stimulus (including a control condition).

Results: Univariate findings (ie, for 1 explanatory variable at a time) showed agitation to be related to several personal attributes—ie, female gender was related to verbal agitation ($P < .0001$); low cognitive function was related to total, verbal, and physical agitation ($P < .001$ for each); low performance of activities of daily living was significantly related to all types of agitation ($P < .01$ for total agitation and $P < .05$ for each type of agitation); and unclear speech was significantly related to total agitation ($P < .01$). Eight of the 9 stimulus categories were significantly related to decreased levels of agitation, with ORs ranging from 0.37 (live human stimuli, $P < .001$) to 0.79 (inanimate social stimuli, $P < .05$). Higher levels of engagement were related to lower levels of agitation ($P < .001$ for total agitation). In the multivariate analyses, higher cognitive function ($P < .001$), male gender ($P < .05$), level of engagement with stimuli (eg, duration of engagement for 3 minutes or longer, $P < .05$), and all 9 stimulus categories, with the exception of music, were independently predictive of lower levels of agitation ($P < .001$).

Conclusions: The finding that both type of stimuli and engagement level with the stimuli were significant predictors of agitation underscores the importance of engagement as a determinant of agitation levels.

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Agitation, defined as inappropriate verbal, vocal, or motor activity that is not judged by an outside observer to be an obvious outcome of the needs or confusion of the individual,[1] is a common reason for nursing home placement.[2] The onset of behavioral symptoms such as agitation can result in institutionalization[3,4] and cause increased burden on caregivers,[5] thereby increasing staff absenteeism and turnover in nursing homes. Although agitation can manifest itself in any individual, it can be particularly disruptive in persons with dementia.[6] Agitated behaviors can be classified as verbal or physical and aggressive or nonaggressive.[7–10]

The prevalence of agitation among cognitively impaired persons varies with cognitive functioning and type of behavior.[11,12] Researchers have identified predictors and correlates of agitation in elderly persons. According to several studies, agitation can stem from physical pain or discomfort, a need for social contact, or a feeling of boredom and inactivity.[13,14] Several studies have found cognitive functioning to be a major predictor of agitation,[15–18] with greater impairment typically resulting in increased agitation. Difficulties in performing activities of daily living (eg, toileting) have been identified as a possible precursor to agitation.[15,17]

Findings concerning demographic correlates of agitation have been mixed. While multiple studies have reported a higher prevalence of aggressive behaviors among men[18,19] and verbally agitated behaviors among women,[15,18] others have not.[19] As to an association between environmental factors and agitation, fewer people per dwelling, increased privacy, reduced noise, and a calm, home-like atmosphere are known to contribute to better functioning and quality of life for nursing home residents with dementia.[20,21] Pacing, a physically nonaggressive behavior, has been found to occur most often in the presence of normal sound levels (rather than very quiet or noisy) and with normal light levels (rather than dark or very bright), while verbally agitated behavior has been found to occur most often when agitated nursing home residents with dementia are alone (rather than when other persons are in the room).[22] Agitated behaviors are often the result of a discrepancy between the needs of the person who suffers from dementia and the degree to which his environment fulfills these needs.[2,23] Consequently, a successful intervention is one that provides a specific activity/item/person for the purpose of addressing underlying unmet needs in addition to entertaining. Research has shown that music[24–28] and structured activities (ranging from trivia games to puzzles)[29,30] have a positive impact on decreasing agitation. Some studies show that when massage is used in combination with other interventions (eg, aromatherapy, conversation), treatment is more effective.[31,32] Social contact has been effective in decreasing agitation among people with dementia.[24,33] When visitors are not present, simulated interaction (eg, audiotapes or videotapes of family members) has been shown to decrease agitation.[28,34] However, high social interaction can sometimes increase agitation,[16] perhaps when it is overwhelming or undesired. Research has demonstrated that

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Clinical Points

- Nonpharmacologic interventions for physical agitation in persons with dementia should include activities and engaging stimuli.
- Caregivers should use every opportunity to engage in one-on-one pleasant verbal contact with the person with dementia in order to prevent agitation.
- In addition to the significant impact of personal attributes on agitation, engagement with stimuli has an independent and potent role in the extent to which agitation is manifested.

animal-assisted therapy[35] and simulated animal-assisted therapy[36] can be beneficial in decreasing agitation in people with dementia.

While the literature contains a variety of examples of intervention stimuli that have been found to be effective for reducing agitated behaviors, we do not know how the extent to which persons are engaged with a given stimulus impacts the degree to which agitation is reduced. As previous research has demonstrated a link between agitation and lack of activities as well as a link between an increase in interest and a decrease in agitation,[37] our assumption is that, when nursing home residents are agitated due to boredom, which is typically manifested as physical agitation, the degree of engagement would be expected to decrease agitation. On the other hand, if boredom is not an issue, such as when agitation stems from other unmet needs (eg, discomfort, loneliness) and is manifested as verbal agitation, we would expect less of an effect since the residents would most likely see the stimuli as a distraction or a bother. We examine this relationship together with a comprehensive examination of the predictors of agitation, namely the impact of personal (eg, level of cognitive functioning), environmental (eg, background noise, lighting), and stimulus attributes on agitation in the present study.

METHOD

Participants

Participants were 193 residents of 7 Maryland nursing homes. All had a diagnosis of dementia. One hundred fifty-one participants (78%) were female, and mean age was 86 years (range, 60–101). The majority were white (81%), followed by African-Americans (10%). Most were widowed (65%) or married (20%). As to education, 18% had less than high school education, 45% had high school education, and the rest had obtained trade school/partial college education (12%), a bachelor's degree (13%), or graduate degree (12%). Activities of daily living performance was measured with the Minimum Data Set,[38] which rates activities from 1 ("independent") to 5 ("complete dependence"). The participants' mean score on the Minimum Data Set was 3.6 (SD = 1.0). Cognitive functioning was assessed via the Mini-Mental State Examination (MMSE),[39] and participants' mean score was 7.2 (SD = 6.3 [range, 0–23]). Participants had a mean of 6.7 medical diagnoses.

Assessments

Environmental attributes: setting and presentation. Background noise, lighting, and number of persons in proximity were obtained via the environment portion of the Agitation Behavior Mapping Inventory.[40] Background noise was recorded as 1 = none, 2 = low, 3 = moderate, 4 = high, and 5 = very high. Lighting was recorded as 1 = bright, 2 = normal, and 3 = dark. The number of persons in close proximity to the participant was recorded as 1 = 0, 2 = 1 person, 3 = 2 persons, 4 = 3 persons, 5 = 4 to 9 persons, 6 = 10 to 24 persons, and 7 = 25+ persons.

Personal attributes. Demographic and medical data were retrieved from the residents' charts at the nursing homes. The MMSE[39] was administered to each participant by a trained research assistant. Data assessed using the Minimum Data Set [38] included those pertaining to activities of daily living, speech clarity (1 = no speech, 2 = unclear speech, 3 = clear speech), making oneself understood (from 1 = rarely/never understood to 4 = understood), vision (from 1 = severely impaired to 5 = adequate), and hearing (from 1 = highly impaired to 4 = hears adequately). In order to determine past interests of the participant, we interviewed the resident whenever possible and also conducted a telephone interview with a close relative using the Self-Identity Questionnaire.[41] The number of leisure activities that had been named as a past interest was calculated for each resident.

Stimulus attributes. Twenty-five different predetermined engagement stimuli were categorized as live human social stimuli—a real baby, one-on-one socializing with a research assistant; simulated social stimuli—a life-like baby doll, robotic animal, respite video[42,43]; inanimate social stimuli—a childish-looking doll, plush animal; real pet—a visiting dog; reading stimulus—a large-print magazine; manipulative stimuli—a squeeze ball, tetherball, expanding sphere, activity pillow, building blocks, fabric book, a wallet (men)/purse (women), puzzle; music stimulus—listening to music; task/work-related stimuli—arranging flowers, coloring with markers, stamping envelopes, folding towels, sorting envelopes; and 2 different self-identity stimuli that were matched to each participant's past role-identity.

Engagement was measured via the Observational Measurement of Engagement.[44] Data from the Observational Measurement of Engagement were recorded through direct observations using specially designed software installed on a handheld computer, the Palm One Zire 31 (PalmOne, Inc, Milpitas, California). Mean intraclass correlation was 0.78 for the engagement variables.[44] The dimensions of engagement were duration, attention, and attitude. Duration refers to the amount of time that the participant was occupied/involved with a stimulus. Whenever a participant refused a stimulus (through words or actions), this was rated as 0

duration. Attention to the stimulus occurs when the resident is focused on the stimulus (eg, eye contact/tracking, facial, motoric or verbal feedback). Attention was measured on a 4-point scale: not attentive, somewhat attentive, attentive, and very attentive. Level of attention observed during most of the trial and the highest attention level during the trial were recorded. Attitude toward the stimulus is observed as positive or negative facial expression, verbal content, and/or physical movement toward the stimulus. Attitude was measured on a 7-point scale, from 1 (very negative) to 7 (very positive). Attitude to the stimulus seen during most of the trial was recorded as well as the highest rating of attitude observed. Further description of the dimensions of engagement can be found elsewhere.[44]

Agitation. Direct observations were recorded via the Agitation Behavior Mapping Inventory,[40] for which a trained research assistant recorded the frequency of occurrence of 14 items describing problem behaviors, characterized as physical agitation (eg, pacing, repetitive behaviors) or verbal/vocal agitation (eg, screaming, complaining, attention-seeking). Mean interrater reliabilities regarding agitated behaviors for this instrument 0.93.[40]

Procedure

The study was approved by the Institutional Review Board of the Charles E. Smith Life Communities. Informed consent was obtained for all study participants from their relatives or other responsible parties.[45] Our inclusion criterion was a confirmed diagnosis of dementia, which was obtained by examining diagnosis on admission, by physicians, and from the Minimum Data Set. Exclusion criteria were a diagnosis of bipolar disorder or schizophrenia, an absence of dexterity/movement in either hand, inability to be seated comfortably in a chair/wheelchair, MMSE score > 23, and age younger than 60 years.

During the data collection phase, each participant was presented with the 25 different predetermined stimuli over a period of 3 weeks (approximately 4 stimuli per day). Each stimulus was presented twice to each participant: once with a minimal introduction and once with a longer introduction that included stimulus modeling. In addition, a control condition, consisting of 2 trials—minimal introduction and long introduction—was included for each study participant. The control trials consisted of a 3-minute observation in which the research assistant provided an introduction (minimal or long) but no stimulus was presented. Individual trials were separated by an intertrial interval of at least 5 minutes. The order of stimulus and control condition trials was randomized for each participant. Environmental and stimulus attributes as well as engagement and agitation were recorded during each observation. Specific details of the data collection protocol are published elsewhere.[44]

Analytic approach. The 3 measures of agitation (total, physical, verbal) and the 3 measures of engagement (attention, attitude, duration) were treated as ordinal variables with 4, 4, 4, 4, 5, and 5 categories, respectively. Although engagement duration could have been treated as a continuous variable, it had a high proportion of 0 values and therefore was categorized using the zeros as the first category and 4 other categories with similar frequencies—1–35, 36–100, 101–179, and ≥ 180 seconds—as the other 4 categories. For each stimulus, the attention and attitude scores were assessed according to (a) the highest value displayed and (b) the value observed during most of the trial. Therefore, in the multivariate analyses, a mean of (a) and (b) was calculated for attention (with 6 categories); similarly, a mean of (a) and (b) was calculated for attitude (with 7 categories).

A proportional odds model with repeated measurements for the different stimuli was then fitted by using Generalized Estimating Equations, executed by the Genmod Procedure[46] with the option "Repeated" in SAS version 9.2 (SAS Institute Inc, Cary, North Carolina), assuming a multinomial distribution for the outcome variables and the cumulative logit link. The Generalized Estimating Equations approach allowed us to examine the effects of different types of stimuli presented to the same participant, taking account of the within-person correlations between the outcomes following each stimulus. The dependent variable was 1 of the 3 measures of agitation. The explanatory variables included type of stimulus (10 nominal categories, ie, 9 stimulus categories and 1 control category), introduction (long vs short), age, gender, marital status, ethnicity, education, number of diagnoses, number of medications, number of psychotropic medications, MMSE, activities of daily living, clarity of speech, count of past interests, vision, hearing, sound, lighting, number of people present, and the 3 measures of engagement.

The process of building the multivariate model for each agitation outcome started with fitting a univariate model for each explanatory variable. The explanatory variables that were potentially meaningful ($P < .2$) were then entered into a backward elimination procedure. In this procedure, the least significant variables were eliminated sequentially until all remaining variables were significant at the 5% level. This constituted the final multivariate model.

RESULTS

Agitation was observed in only 31% of the observations. A score of 10 or more agitated behaviors per 3-minute observation period was observed in only 10% of assessments. In order to provide further validation for the observational method, we employed the Cohen-Mansfield Agitation Inventory (CMAI)[7] to capture staff perceptions of the level of agitation during the 2 weeks prior to the initiation of Agitation Behavior Mapping Inventory observations. The Pearson correlation between CMAI ratings and the levels of agitation observed during the control Agitation Behavior Mapping Inventory trials was significant ($r = 0.305$, n = 191, $P < .001$), supporting the validity of the observational Agitation Behavior Mapping Inventory method for capturing meaningful agitation.

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Table 1. Univariate Relationships of Environmental and Personal Factors to Agitation: Results of Generalized Estimating Equations Univariate Analyses[a]

	Total Agitation			Verbal Agitation			Physical Agitation		
Variable	OR	95% CI	*P*	OR	95% CI	*P*	OR	95% CI	*P*
Type of stimulus			**<.0001**			**.004**			**<.0001**
Control	1.00			1.00			1.00		
Manipulative	0.74	0.62–0.89	.002	0.89	0.71–1.12	.337	0.70	0.57–0.87	.001
Reading	0.66	0.50–0.88	.004	0.72	0.51–1.02	.061	0.67	0.49–0.92	.013
Identity	0.69	0.53–0.90	.005	0.82	0.60–1.13	.225	0.70	0.52–0.94	.018
Music	0.87	0.69–1.10	.251	0.84	0.61–1.16	.296	0.91	0.70–1.19	.480
Task/work	0.68	0.56–0.82	.0001	0.91	0.72–1.15	.426	0.59	0.47–0.74	<.0001
Live human	0.37	0.26–0.51	<.0001	0.41	0.26–0.63	<.0001	0.43	0.30–0.63	<.0001
Pet	0.55	0.39–0.79	.001	0.91	0.60–1.38	.648	0.47	0.31–0.73	.001
Simulated social	0.78	0.62–0.97	.026	1.00	0.78–1.29	.993	0.69	0.54–0.88	.003
Inanimate social	0.79	0.64–0.99	.042	1.02	0.77–1.35	.874	0.67	0.51–0.87	.003
Personal attributes									
Age, y			.650			**.058**			.980
< 84.05	1.00			1.00			1.00		
84.05–89.78	0.87	0.57–1.32	.501	0.65	0.39–1.07	.089	1.05	0.65–1.71	.844
≥ 89.79	1.05	0.69–1.60	.821	1.15	0.68–1.92	.606	1.03	0.66–1.61	.901
Gender									
Male	1.00			1.00			1.00		
Female	1.47	0.98–2.19	**.057**	3.17	1.89–5.31	**<.0001**	0.99	0.64–1.53	.957
Marital status									
Other than married	1.00			1.00			1.00		
Married	0.82	0.56–1.21	.313	0.68	0.39–1.19	**.150**	0.88	0.58–1.35	.557
Race									
Other than white	1.00			1.00			1.00		
White	1.05	0.72–1.54	.803	1.55	0.97–2.47	**.056**	0.92	0.58–1.46	.725
MMSE			**<.0001**			**.0003**			**<.0001**
< 3	1.00			1.00			1.00		
3–9	0.55	0.37–0.83	.004	0.62	0.38–1.02	.060	0.55	0.36–0.85	.008
≥ 10	0.31	0.22–0.45	<.0001	0.35	0.22–0.55	<.0001	0.29	0.19–0.45	<.0001
Activities of daily living Minimum Data Set score			**.002**			**.028**			**.022**
< 1.6	1.00			1.00			1.00		
1.6–2.9	0.89	0.59–1.34	.574	0.87	0.54–1.42	.585	0.95	0.60–1.52	.839
> 2.9	0.51	0.34–0.76	.001	0.51	0.30–0.87	.013	0.58	0.37–0.89	.014
Clarity of speech			**.009**			**.109**			**.007**
Clear speech	1.00			1.00			1.00		
Unclear speech	2.03	1.37–3.02	.0005	1.79	1.10–2.90	.018	2.20	1.45–3.34	.0002
No speech	1.87	0.52–6.71	.336	1.32	0.64–2.73	.456	2.23	0.45–11.03	.326
No. of medications	0.94	0.90–0.99	**.012**	0.96	0.90–1.02	**.188**	0.92	0.87–0.97	**.003**
Environmental attributes									
Long introduction	0.94	0.87–1.02	**.132**	1.00	0.90–1.11	.997	0.91	0.83–1.00	**.042**
Sound			.300			**.130**			.698
None	1.00			1.00			1.00		
Low	1.01	0.41–2.50	.984	0.96	0.32–2.85	.939	1.09	0.41–2.86	.865
Moderate	0.94	0.38–2.34	.896	0.78	0.27–2.26	.648	1.20	0.44–3.25	.725
High	1.29	0.48–3.48	.613	1.20	0.38–3.82	.752	1.41	0.48–4.11	.532
Lighting			**.133**			**.066**			.247
Normal	1.00			1.00			1.00		
Bright	1.59	0.99–2.56	.054	2.00	1.16–3.47	.013	1.47	0.93–2.32	.100
Dark	1.11	0.80–1.53	.539	1.26	0.87–1.81	.223	0.97	0.65–1.45	.899
Engagement									
Duration, s			**<.0001**			**.0002**			**<.0001**
0	1.00			1.00			1.00		
1–35	1.71	1.38–2.11	<.0001	1.41	1.10–1.80	.006	1.94	1.53–2.45	<.0001
36–100	1.23	0.97–1.56	.094	1.22	0.90–1.65	.198	1.29	1.00–1.68	.054
101–179	1.07	0.82–1.40	.612	1.29	0.91–1.83	.155	0.99	0.75–1.33	.971
180+	0.57	0.46–0.72	<.0001	0.77	0.58–1.04	.085	0.45	0.34–0.58	<.0001
Attention most of the time[b]			**<.0001**			**<.0001**			**<.0001**
None (1)	1.00			1.00			1.00		
Low (2)	1.32	1.07–1.63	.009	1.35	1.03–1.76	.028	1.32	1.05–1.66	.019
Moderate (3)	0.65	0.50–0.84	.001	0.86	0.62–1.18	.342	0.51	0.38–0.69	<.0001
High (4)	0.59	0.41–0.84	.004	0.49	0.33–0.73	.001	0.73	0.48–1.11	.149
Attitude most of the time[b]			**<.0001**			**.001**			<.0001
Negative (1–3)	1.00			1.00			1.00		
Neutral (4)	0.43	0.28–0.65	<.0001	0.33	0.21–0.53	<.0001	0.56	0.34–0.90	.018
Somewhat positive (5)	0.43	0.30–0.62	<.0001	0.36	0.24–0.53	<.0001	0.58	0.38–0.88	.010
Positive (6)	0.24	0.16–0.36	<.0001	0.26	0.16–0.40	<.0001	0.22	0.13–0.37	<.0001
Very positive (7)	0.15	0.07–0.33	<.0001	0.20	0.08–0.52	.001	0.09	0.03–0.29	<.0001

[a]Boldface numbers indicate a level of significance of $P < .2$. The personal attributes of education, number of diagnoses, count of past interests, number of psychotropic medications, vision, hearing as well as the environmental attribute of number of persons in the environment did not reach $P < .2$. The other indicators of engagement (attention highest, and attitudes highest) are not shown, as these mirror those of attention and attitude most of the time. Results available upon request. [b]The parenthetical numbers correspond to the score for each rating category.
Abbreviations: MMSE = Mini-Mental State Examination, OR = odds ratio.

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Table 2. Results of Generalized Estimating Equations Multivariate Analyses—Total Agitation: With and Without Engagement

Variable	Without Engagement, OR	Adding Engagement Duration OR	Adding Engagement Duration 95% CI	Adding Attention OR	Adding Attention 95% CI	Adding Attitude OR	Adding Attitude 95% CI
Stimulus attributes							
Control	1.00	1.00	…	1.00	…	1.00	…
Live human	0.37***	0.47***	0.32–0.69	0.43***	0.29–0.63	0.43***	0.29–0.64
Pet	0.55**	0.50***	0.34–0.74	0.58**	0.39–0.87	0.64*	0.43–0.95
Task/work	0.63***	0.65***	0.52–0.80	0.70**	0.54–0.91	0.64***	0.50–0.83
Reading	0.65**	0.62**	0.46–0.83	0.68*	0.49–0.93	0.66**	0.48–0.90
Identity	0.68**	0.71*	0.54–0.94	0.73	0.53–1.01	0.71*	0.52–0.97
Manipulative	0.69***	0.64***	0.53–0.78	0.73**	0.57–0.93	0.70**	0.55–0.89
Inanimate social	0.73**	0.68**	0.53–0.87	0.75*	0.56–0.99	0.76*	0.58–1.00
Simulated social	0.74*	0.74*	0.58–0.95	0.77	0.58–1.03	0.78	0.59–1.04
Music	0.82	0.80	0.62–1.03	0.84	0.63–1.14	0.86	0.64–1.16
Personal attributes							
MMSE score							
<3	1.00	1.00	…	1.00	…	1.00	…
3–9	0.54**	0.54**	0.36–0.81	0.53**	0.35–0.80	0.51**	0.34–0.78
≥10	0.30***	0.32***	0.22–0.46	0.31***	0.21–0.46	0.30***	0.20–0.43
Sex (male = 1)							
Female	1.58*	1.60*	1.03–2.48	1.61*	1.02–2.52	1.60*	1.02–2.52
Engagement							
Duration, s				Value[a]	OR	Value[b]	OR
0	…	1.00	…	1	…	2.5	2.45*** 1.52–3.92
1–35	…	1.97***	1.58–2.47	1.75	1.64*** 1.33–2.03	4.25	0.79* 0.64–0.97
36–100	…	1.50**	1.17–1.94	2.5	1.38* 1.06–1.79	5	1.00 …
101–179	…	1.40*	1.08–1.82	3	1.18 0.88–1.59	5.5	0.81 0.65–1.02
≥180	…	0.78*	0.61–0.99	3.5	0.72* 0.53–0.96	6	0.72* 0.55–0.95
				4	0.85 0.59–1.23	6.5	0.45*** 0.31–0.66
						7	0.35* 0.13–0.90

[a]Attention. [b]Attitude. *P < .05, **P < .01, ***P < .001.
Abbreviations: MMSE = Mini-Mental State Examination, OR = odds ratio.

Univariate Relationships With Agitation

Stimulus attributes. Univariate associations (ie, those unadjusted for other factors) show that, with the exception of music, all stimuli significantly decreased total agitation (Table 1). These effects can be explained by the impact of the stimuli on physical agitation. While the coefficients for verbal agitation were generally in the same direction as physical agitation, ie, for most stimuli, all types of agitation tended to be lower during stimulus presentation than during the control condition, only the live human engagement stimulus had a significant effect on verbal agitation.

Environmental attributes. A long introduction of the stimulus with modeling was associated with significantly lower levels of physical agitation. Number of persons in proximity, levels of light, and levels of sound were not associated with significant changes in agitation levels.

Personal attributes. Univariate associations of personal characteristics with agitation (Table 1) show the following to be related to agitation: higher levels of cognitive function were significantly associated with lower levels of agitation, and, similarly, higher levels of functional status in the performance of activities of daily living and clear speech were associated with significantly less agitation. Also, female gender was associated with verbal agitation. Physical agitation was associated with comparatively fewer medications. Results were not statistically significant for hearing or vision impairment or for number of psychotropic medications.

Engagement. All types of agitation were significantly associated with engagement. The same pattern was seen for duration and attention: very low levels of engagement were associated with more agitation than was no engagement at all, while high levels of engagement were associated with less agitation. A linear relationship was seen for attitude, with more positive attitudes generally resulting in less agitation.

Multivariate Analyses

Results of the multivariate analyses are presented in Table 2, first without engagement and then with it. Without engagement, lower levels of total agitation are associated with all stimuli except music, with higher levels of cognitive function, and with male gender. For physical agitation (Table 3), the same pattern is found except that lower levels are explained by a lower number of medications rather than male gender. For verbal agitation, whereas the odds ratios for stimuli were all less than 1, these differed significantly from the control condition for only the live human and the reading stimuli. Low cognitive function and female gender were associated with higher levels of verbal agitation.

Adding engagement to the multivariate analyses resulted in engagement being an additional significant predictor (Table 2). This was true for each type of agitation measure and each type of engagement measure, although results are presented for total agitation only.

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Table 3. Results of Generalized Estimating Equations Multivariate Analyses—Physical and Verbal Agitation Without Engagement

	Physical Agitation		Verbal Agitation	
Variable	OR	95% CI	OR	95% CI
Stimulus attributes (in same order as for total agitation)				
Control	1.00		1.00	
Live human	0.45***	0.30–0.67	0.40***	0.26–0.62
Pet	0.48***	0.31–0.74	0.89	0.57–1.40
Task/work	0.56***	0.44–0.71	0.84	0.65–1.08
Reading	0.67*	0.48–0.92	0.69*	0.48–1.00
Identity	0.70*	0.52–0.95	0.78	0.56–1.10
Manipulative	0.66***	0.53–0.82	0.81	0.64–1.03
Inanimate social	0.62***	0.47–0.82	0.91	0.68–1.23
Simulated social	0.66**	0.51–0.86	0.92	0.71–1.21
Music	0.87	0.65–1.16	0.78	0.56–1.10
Personal attributes				
MMSE score				
< 3	1.00		1.00	
3–9	0.61*	0.39–0.95	0.59*	0.36–0.97
≥ 10	0.31***	0.20–0.48	0.33***	0.21–0.51
No. of medications	0.95*	0.90–0.99		
Gender				
Male			1.00	
Female			3.35***	1.90–5.89

*$P < .05$, **$P < .01$, ***$P < .001$.
Abbreviations: MMSE = Mini-Mental State Examination, OR = odds ratio.

DISCUSSION

The present study examined the impact of environmental, personal, and stimulus attributes on agitation and examined whether engagement to stimuli influenced levels of agitation. The results show that both personal and stimulus attributes concurrently and independently predicted levels of agitation, a combination not reported in prior research.

Findings regarding the impact of personal attributes concur with past reports. The finding that higher levels of cognitive function were significantly associated with lower agitation is congruent with Cohen-Mansfield et al,[11] who observed comparatively lower levels of agitation in the earlier stages of dementia relative to levels of agitation in advanced dementia. The link between better activities of daily living performance and lower levels of agitation is similar to the results of Cohen-Mansfield and Libin,[15] as is the association between female gender and verbal agitation. The variables of activities of daily living and clarity of speech, while significant in the univariate analyses, did not emerge significant in the multivariate model, probably due to collinearity with cognitive function. Similarly, the fact that those manifesting physical agitation are healthier relative to other nursing home residents has been previously reported.[47]

As to environmental attributes, while the impact of a long stimulus introduction was significantly associated with less physical agitation in the univariate analyses, it was not significant when the type of stimuli was included in the multivariate model. One possibility for this result is that the impact of the introduction may be different for different stimuli, but the impact of the introduction may not be as potent as the differences among stimuli. We did not examine the interaction between stimuli and introduction in the present study. This is a topic that could be explored in future studies. Analyses with lighting, background noise, and number of persons in proximity did not reach statistical significance. For lighting and noise, this result may be due to little variation in these variables during our trials and to our reliance on subjective perception scales. Future research should use an objective measurement, such as a light meter. Our findings regarding the impact of environmental attributes on agitation are not consistent with those of a previous study.[22] In that study, we found that pacing tended to occur during normal levels of noise and light (rather than with very quiet or noisy backgrounds or with dark or very bright environments), whereas verbal behaviors tended to occur when the nursing home resident with dementia was alone in the room.[22] However, that research involved 24 very agitated persons in contrast with the current approach of a large sample of persons with dementia, regardless of their levels of agitation. In addition, those residents were observed throughout the 24 hours of the day, yielding a greater number of observations per participant. Further study is needed to clarify whether the discrepancies in results are due to different populations, different methodologies, or other factors.

While it has been shown in nursing home residents with dementia that one-on-one human interaction is a potent engaging stimulus[33] and that human contact can significantly decrease agitation,[24] this is the first study to demonstrate, through Generalized Estimating Equations analysis, that even when the stimuli are entered into the model of agitation, engagement remains a significant predictor. This underscores the importance of stimulation in reducing agitation in this population.

The magnitude of the impact of live human contact was the highest of all stimuli and was significant for both verbal and physical agitation, suggesting that the nursing home culture needs to include increased availability of social stimuli for residents. At present, social contact for nursing home residents is limited.[48–50] Nursing staff are often responsible for numerous residents and consequently cannot provide extensive individual attention to each resident. Additionally, daily instances of one-on-one contact of nursing home staff and residents with dementia (eg, dressing), are often spent in silence and without social interaction,[51] indicating that staff members would benefit from training pertaining to better utilization of such time. Nursing home administrators might also consider providing training and mentoring for volunteers and family members so that they learn to interact effectively and consistently with residents in a mutually rewarding way.

The results of the present study support previous findings that physical agitation is related to boredom and lack of activity, while verbal agitation stems from other unmet needs such as discomfort and loneliness.[13] Indeed, most stimuli had a significant impact on physical agitation, as those provided stimulation; on the other hand, only live human interaction, which can relieve loneliness, strongly impacted verbal agitation.

We had anticipated less agitation when participants were engaged for longer periods of time, and were surprised to find that residents engaged for short periods were more agitated than those who were not engaged at all. The explanation provided by the research assistants who had conducted the trials was that the residents who were unengaged were often completely passive and showed no involvement with their surroundings, exhibiting neither engagement nor agitation. In contrast, those who were agitated were involved with their surroundings and thus would have very short periods of engagement with the stimuli.

Further research is needed and should be designed to overcome limitations of the present study. The first limitation, the relatively low levels of agitation manifested by the study participants, was due to selection criteria by dementia rather than by agitation. Secondly, participants who refused stimuli were not observed, thus potentially lowering the levels of agitation. Third, observations of agitation were conducted during specific hours of the day and never during activities of daily living, which also contributed to the relatively low level of observed agitation. The results, therefore, reflect predictors of agitation under those circumstances.

Agitated behaviors in persons with dementia can take an emotional toll on caregivers and loved ones as these can be embarrassing and anxiety provoking and can be detrimental to the resident's quality of life and interpersonal relations. Consequently, it is important that research further develop interventions and stimuli to combat such behaviors. The findings from this article provide empirical support for the use of social engagement interventions for reducing agitation. Future studies should examine the impact of the interaction of stimuli with level of cognitive decline and withdrawal on level of agitation.

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