

Running heading:

Environment and Psychological Well-Being

Title:

Is an Engaging or Soothing Environment Associated With the Psychological Well-Being of People With Dementia in Long-Term Care?

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Abstract

Purpose: To examine the relationship between environmental ambience and psychological well-being of persons with dementia.

Design: A secondary analysis was conducted using observational data with repeated measures. A total of 1,857 observations from 177 persons with dementia in 17 nursing homes and 6 assisted living facilities were included.

Methods: Psychological well-being was measured by observed displays of positive and negative emotional expressions. The environmental ambience was assessed by two subscales of the Ambiance

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Scale: Engaging and Soothing. Multilevel modeling was used to account for hierarchical structures in the data.

Findings: An engaging environment was associated with more positive emotional expressions after controlling for covariates. However, a soothing environment was associated with neither positive nor negative emotional expressions.

Conclusions: Results suggest that the environment is an important consideration for administrators and clinicians as they respond to the mandate to actively plan and provide care to persons with dementia.

Clinical Relevance: An environment that is relevant and interesting may promote a sense of well-being and support resident-centered care.

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Body of article

An estimated 46.8 million people worldwide were living with dementia in 2015 (Alzheimer's Disease International, 2015); more than 40% of residents in residential care facilities have Alzheimer's or another type of dementia in the United States (Molica & Ujvari, 2012). In addition, average out-of-pocket costs for older adults with dementia in long-term care were the highest among Medicare beneficiaries (Alzheimer's Association, 2015). Although the Centers for Medicare and Medicaid Services (CMS) established improvement of dementia care as a national priority, including person-centered care for nursing home residents, the majority of long-term care studies have focused on behavioral problems in persons with dementia rather than psychological well-being (CMS, 2013).

The measurement of psychological well-being, a key determinant of quality of life (QoL; Ferrans, 2005) poses a challenge in dementia research. Psychological well-being, a multidimensional phenomenon that typically relies on self-report, is difficult to obtain from persons with moderate to severe dementia due to language impairment (Beer et al., 2010). However, some studies have shown that psychological well-being of persons with dementia can be reliably measured using observed displays of emotional expression (Kolanowski, Litaker, & Catalano, 2002; Lee, Algase, & McConnell, 2013).

According to the Ecology Theory of Aging (ETA) by Lawton and Nahenow (1973), combinations of person-related competencies and environments affect individuals' behaviors and function. The ETA suggests that intrapersonal characteristics (e.g., personality and cognitive function) and environmental factors interact to influence successful aging. In persons with dementia, behavioral issues have been long recognized as signs of chaotic interactions with the environment (Roberts & Algase, 1988). The significant relationship between personality and psychological well-being in persons with cognitive impairment was supported (Burgener, Twigg, & Popovich, 2005).

In general, people relate to the environment on an emotional level. Brain pathways that process emotions are relatively spared in dementias such as Alzheimer's disease (Algase et al., 2007). As cognitive processes decline, emotion is considered the salient mechanism by which persons with dementia relate to and process information from and about the environment (LeDoux, 1996; Panksepp, 1998).

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The Environment and Psychological Well-Being

The environment is an important factor to consider when enhancing psychological well-being in persons with dementia because it is modifiable and can be used as a nonpharmacological intervention (Flynn, Liang, Dickson, & Aiken, 2010; Szanton et al., 2011). Examining the relationship between the environment and well-being in dementia is relatively recent research, and the results are mixed. Studies have reported the influence of the environment on nursing home residents' behavioral manifestations of psychological distress. Residents in small-scale, homelike living facilities showed less aggressive behaviors but more aberrant motor behaviors than residents in traditional wards (Verbeek et al., 2014). Using a global rating of self-reported QoL, a recent study showed that a high quality rating of the overall physical environment is associated with better QoL in nursing home residents with dementia, but the association was no longer significant with the use of proxy or detailed self-report ratings (Fleming, Goodenough, Low, Chenoweth, & Brodaty, 2014).

A small number of studies showed the effect of specific physical environmental determinants (i.e., temperature, noise, and light) on the well-being of persons with dementia in long-term care. An observational study in Spain reported that high temperature in the bedroom was significantly associated with lower QoL of nursing home residents with severe dementia after controlling for residents' pain scores, psychiatric symptoms, and functional levels (Garre-Olmo et al., 2012). One Canadian qualitative study found that noise was one of the most important physical environment determinants on well-being of persons with dementia (Garcia et al., 2012). This study also emphasized the importance of human environments, such as interaction with staff, individualized care, and activities to improve well-being in nursing home residents. Thus, more studies are needed to confirm the relationship between the quality of the environment and psychological well-being of persons with dementia in long-term care using valid measurements.

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Environmental Ambience

Environmental interventions for the person with dementia have largely focused on modifying environmental ambience, defined as the overall effect of physical and social environment that generates affective and behavioral responses (Algase et al., 2007). In persons with dementia, positive environmental ambience has been characterized as either promoting engagement of the resident or soothing the resident (Algase et al., 2007). Engagement, defined as the act of being occupied or involved with an external stimulus (Cohen-Mansfield, Dakheel-Ali, & Marx, 2009), has been associated with positive emotional responses, including the relief of apathy, boredom, depression, and loneliness in nursing home residents (Sifton, 2001). Thus, quality environments are frequently described as providing features that are interesting and promote cognitive and physical activity. Accordingly, an engaging environment would support emotional interaction (Algase et al., 2007) and likely yield positive emotions in persons with dementia.

Additionally, physical plan features (such as ambient lighting and sound) that are soothing have been found to positively influence behavior (Algase, Beattie, Antonakos, Beel-Bates, & Yao, 2010). Thus, a soothing environment would lessen anxiety and promote calm (Algase et al., 2007) and likely yield positive emotions in persons with dementia. However, the contribution of these environmental characteristics to the emotional status of nursing home residents is not well known.

The present study examined the relationship between environmental ambience, using an observational rating scale of the immediate nursing home environment, and psychological well-being of persons with dementia, using observed displays of emotional expression. The purpose was to evaluate the influence of the environmental ambience on psychological well-being. The following hypotheses were tested:

Inset list:

H1: An engaging environment is associated with positive but not negative emotional expression, after controlling for cognitive status, premorbid personality trait, comorbidity, and demographic variables.

H2: A soothing environment is associated with positive but not negative emotional expression, after controlling for cognitive status, premorbid personality trait, comorbidity, and demographic variables.

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Methods

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Data Source and Participants

This is a secondary analysis of data from persons with dementia who lived in residential long-term care (Algase et al., 2008). The parent study utilized a nested within subjects design to evaluate background and proximal factors of the phenomenon of wandering. The parent study included 185 persons with dementia in 17 nursing homes and 6 assisted living facilities from two states in the United States who were 65 years of age or older, were English-speaking, had a Mini-Mental Status Examination (MMSE) score of <24/30, met *Diagnostic and Statistical Manual of Mental Disorders* (4th edition; DSM-IV) criteria for dementia, and were not wheelchair-bound. Facilities were selected using a random cluster sampling. Participants who met inclusion criteria were randomly assigned to twelve 20-min observation periods once per hour. The environmental ambience was assessed at the end of each observation period by the research assistant who videotaped the participant. All observation periods were videotaped and occurred from 8 AM to 8 PM. After institutional review board approval from the university and each participating facility, written consent was obtained from legal proxies of participants and assent was also obtained from participants prior to every observation. All research assistants (RAs) received 8 to 12 hr of training before data collection. In addition, desensitization of staff and residents to videotaping equipment occurred during the subject screening process (Algase et al., 2008); cameras were placed in locations throughout the facility for 1- to 2-hr periods, but no taping was done.

The present study used data from those participants who completed more than three emotional expression observations that evaluated psychological well-being. Thus, a total of 177 participants with 1,857 observations were included. There were no significant differences in demographic characteristics between participants who were included and excluded in this study.

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Measures

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Dependent variable. Psychological well-being was measured by the Observable Displays of Affect Scale (ODAS), which was designed to rate videotaped emotional expressions of persons with cognitive impairment. The ODAS contains 34 items of positive and negative facial displays, vocalizations, and body movement or posture (Vogelpohl & Beck, 1997). The specific description for each item was provided to trained RAs. RAs coded video tapes of participants' emotional expression using the Noldus Observer® 5.0 software (Noldus Information Technology bv, Wageningen, The Netherlands). In the parent study, an inter- and intra-rater agreement among coders was established at greater than 95% using training videotapes before coding for the ODAS measures began. Reliability was assessed throughout the study by sampling 10% of the videotapes and retraining coders if needed. Evidence substantiating inter-rater reliability (0.68–1.00) and test-retest reliability (0.97–1.00) for the ODAS has been reported (Vogelpohl & Beck, 1997; Whall et al., 2008).

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Independent variable. Environmental ambience was assessed by two subscales of the Ambiance Scale (AS): Engaging and Soothing. The AS is a nine-item instrument to rate immediate nursing home environment by observers using a semantic differential scaling model (+2 to -2), with 0 being neutral, indicating neither a negative nor a positive emotional valence to the environment (Algase et al., 2007). A two-factor solution was obtained in factor analyses and labeled as engaging and soothing (Algase et al., 2007). Each subscale score ranged from -2 to 2. RAs who videotaped emotional expressions administered the AS at the end of each observation period. Cronbach's alphas for the current study were .93 for the engaging subscale and .61 for the soothing subscale.

Covariates. Cognitive status, comorbidity, mobility, premorbid personality traits, facility type, and demographic variables were included as potential covariates.

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Cognitive status. Cognitive status was measured using the MMSE (Folstein, Folstein, & McHugh, 1975). Participants who were too impaired to finish the test were assigned a score of -1, as had been done in the parent study (Algase et al., 2008).

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Comorbidity. Comorbidity was assessed by the Cumulative Illness Rating Scale-Geriatric (CIRS-G), which was developed to reflect medical problems of older adults (Miller et al., 1992). The CIRS-G is a comorbidity index based on physician or nurse practitioner ratings of presence and severity of chronic medical conditions for 14 organ systems, with 0 indicating no problem and 4 indicating severe level of problem. Inter-rater reliability for the CIRS-G total score was reported from 0.78 to 0.88 (Miller et al., 1992), and validity of the scale was established in a study of 439 institutionalized elders by examining its associations with mortality, hospitalization, medication usage, and laboratory findings (Parmelee, Thuras, Katz, & Lawton, 1995).

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Mobility. Mobility was categorized as independent (no need for mechanical devices [e.g., cane, walker]) and assisted (need some mechanical devices or staff assistance to ambulate) by a nurse practitioner.

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Premorbid personality traits. Premorbid personality traits were collected by telephone interview with an informant who was usually a spouse or an adult child using the NEO Five-Factor Personality Inventory (NEO-FFI; Costa & McCrae, 1992). The NEO-FFI is a 60-item, 5-point scale for comprehensive assessment of adult personality in five domains: neuroticism, extraversion, openness, agreeableness, and conscientiousness. Each domain has 12 items, and each item receives a score of 0 (*strongly disagree*) through 4 (*strongly agree*). The informant was asked to respond based on the participant's personality as he or she was 10 years before the onset of dementia. *T* scores were computed from the raw scores of the NEO-FFI five domains using normative sample means and standard deviations, which differ by gender (Costa & McCrae, 1992). Cronbach's alphas obtained from this study were 0.88, 0.85, 0.72, 0.88, and 0.89 for neuroticism, extraversion, openness, agreeableness, and conscientiousness, respectively.

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Facility type. Facility type was categorized as nursing home or assisted living facility.

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Demographic variables. Demographic variables included age (continuous variable), gender (0 = male, 1 = female), and education (1 = less than high school, 2 = high school, 3 = college or higher).

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Time of day. Time of day recorded the time when an observation was made using a 24-hr clock.

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Analysis

To examine the effect of quality of environment on psychological well-being, authors defined the outcome as log-transformed emotional expressions. Since the dependent variables (i.e., positive and negative emotional expression) were skewed (to the right) the log-transformation was used to make the emotional expressions to meet the normal distribution assumption. As the log-transformation preserves the order of the original values (i.e., log is a monotone nondecreasing function), authors interpreted the effect of covariates on emotional expressions based on model coefficients themselves, rather than exponentiated values (Benoit, 2011). A multilevel (mixed) model was employed to account for hierarchical structures in the data. In particular, the emotional expressions were repeatedly measured from individuals where those participants were further nested within facility type (assisted living or nursing home). A study reported that the type of facility may influence the participants' experiences and responses (Beattie, Song, & LaGore, 2005). Therefore, a multilevel model was used based on the assumption that the shared attributes (i.e., repeated measures within the same individuals within the same facility) have an effect on the outcome being modeled. Finally, authors controlled for the time of day variable to allow the emotional expressions to change over time. Characteristics of covariates for possible inclusion in the multilevel model are shown in Table 1. Among the total MMSE score and categorized MMSE variables, the total score was used in the multilevel model. Authors fit univariate multilevel models considering each emotional expression as a sole response. For each response, the final model was chosen by the forward selection method starting from a model controlling for either engaging or soothing environment while allowing for random effects by facility type and individual subject. Each variable was added to assess if the added variable altered the effect of the environment variable. All the analyses were performed with a mixed procedure in Stata 14.0 (StataCorp LP, College Station, TX, USA).

Insert Table 1 about here

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Results

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Participant Characteristics

Table 1 contains participant characteristics. More than 75% of participants were Caucasian and female with an average age of 83.64 years ($SD = 6.39$). The mean MMSE score was 6.93 (range = -1 to 21). Over 59.7% of participants had moderate to severe cognitive impairment ($MMSE \leq 16$) and 26.8% of participants were untestable. The mean positive emotional expression was 65.89 per 20 min, while the mean negative emotional expression was 8.98 per 20 min.

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Positive Emotional Expression

Engaging environment was highly associated with positive emotional expression among persons with dementia, controlling for hour, neuroticism personality trait, and MMSE score ($\beta = 0.173$; $p < .0001$). There was no evidence of random effect by facility type on positive emotional scales. Therefore, facility type was fitted as a fixed effect; however, there was no significant association between positive emotional scales and facility type. Consequently, the final model shown in Table 2 accounted for within-subject correlation only. More engaging environment, higher neuroticism, and higher MMSE score were associated with more positive emotional expression at a given time. Soothing environment was not significantly associated with positive emotional expression at the $\alpha = 0.05$ level, when used as a sole covariate. In addition, there was no added effect by soothing environment on improving positive emotional expression when engaging environment was incorporated in the model. Individual difference was minimal (estimated random effect [ERE] = 0.002; 95% confidence interval [CI] = 0.000, 0.007).

Insert Table 2 about here

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Negative Emotional Expression

Unlike positive emotional expression, the multilevel model for negative emotional expression showed there was statistical evidence for similarity shared by individuals living in the same type of facility, in addition to within-subject correlation. Therefore, the final multilevel model chosen for negative emotional expression reflected such hierarchy. Although either engaging or soothing environment was not significantly associated with negative emotional expression, the investigators found factors influenced negative emotional expression among persons with dementia; higher MMSE score (adjusted coefficient estimate [ACE] = -0.018; 95% CI = -0.027, 0.009) and higher conscientiousness personality (ACE = -0.008; 95% CI = -0.015, 0.002) were shown to be associated with less negative emotional expression at a given time. The effect of facility type on negative emotional expression was minimal (ERE = 0.001; 95% CI = 0.000, 0.473), whereas individual difference has a larger effect in view of its larger variance (ERE = 0.077; 95% CI = 0.048, 0.123). Therefore, expressing negative emotional expression may vary by individual difference rather than facility type among persons with dementia. Table 3 summarizes results obtained from the final multilevel model fit for negative emotional expression.

Insert Table 3 about here

Heading level 1:

Discussion

This is the first study that considers the influence of environmental ambience upon psychological well-being in persons with dementia. The study yielded several important findings. First, an engaging environment was positively associated with more positive emotional expression of persons with dementia after controlling for their cognitive status and other covariates, whereas soothing environment was

associated with neither positive nor negative emotional expressions of persons with dementia. This article's unique contribution to science is to show an immediate effect of environmental quality on emotional expressions of persons with dementia. The nature of the engaging and soothing dimensions of ambiance reflect how one experiences or apprehends the environment unconsciously. It does not require cognition, so is a particularly useful notion in working with individuals with cognitive deficits (Yao & Algase, 2006; Zajonc, 1980).

The positive influence of an engaging environment is corroborated by early studies demonstrating that engagement between persons with cognitive impairment and environmental stimuli has yielded positive emotions and improved QoL (Engelman, Altus, & Mathews, 1999; Orsulic-Jeras, Judge, & Camp, 2000). Results suggest the environment is an important consideration for administrators and clinicians as they respond to the mandate to actively plan and provide care that supports psychological well-being in persons with dementia, and avoid chemical restraints (Bonner et al., 2015). The identification of the discrete characteristics of the environment that promote engagement is an area for future research, as are the potential functional benefits. The contribution of staff efforts as a potential mediator or moderator to engagement also warrants investigation in order to align activity programs with meaningful environmental approaches.

An unexpected finding was the lack of association between a soothing environment and both positive and negative emotional expression. There is a possibility that a soothing environment does not necessarily provide the type of meaningful stimulation that promotes psychological well-being.

Second, two out of five premorbid personality traits were associated with emotional expressions: the neuroticism personality trait was related to more frequent positive emotional expression, while the conscientiousness personality trait was related to fewer negative emotional expressions. The negative relationship between conscientiousness and negative emotional expression is expected because persons with a conscientious personality tend to control their impulses or desires (Costa, McCrae, & Dye, 1991). However, the relationship between neuroticism and positive emotional expression is a somewhat unexpected finding. Traditionally, neuroticism is associated with more negative emotional expression; extraversion is associated with more positive emotional expression. However, according to Ng's (2009, 2012) experimental studies with cognitively intact adults, persons with higher neuroticism showed more negative emotions and fewer positive emotions than persons with lower neuroticism in an unpleasant situation. However, there was no significant emotional expression difference between two groups in a pleasant situation (Ng, 2009, 2012). The response to a pleasant event was as positive in low neuroticism individuals as in high neuroticism individuals. An engaging environment may be beneficial, especially for persons with dementia who have the neuroticism personality trait to improve their psychological well-being. In addition, premorbid personality traits do not reflect current personality but past personality traits. Although personality is relatively stable with aging, research showed that personality changes may happen with a dementia diagnosis (Balsis, Carpenter, & Storandt, 2005; Jacomb & Jorm, 1996; Wang et al., 2009). Thus, it is important to monitor personality changes in persons with and without dementia. Lastly, cognitive status was a significant independent factor on both positive and negative emotional expressions; better cognitive status was associated with more positive emotional expressions and fewer negative emotional expressions. This is a consistent finding with existing literature (Kurz, Scuvee-Moreau, Vernooij-Dassen, & Dresse, 2003). Although cognitive status is not the unique factor influencing psychological well-being among persons with dementia, it is certain that cognitive status is one of the important elements.

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Strengths and Limitations

One of the main strengths of this article was the use of multilevel data; participants are clustered within nursing homes selected by a random sampling mechanism, and their outcomes are measured repeatedly over time. Research has shown that ignoring the hierarchy in data can lead to the underestimation of variance, which can seriously inflate the Type I error rate and overstate the statistical significance of an effect of a factor of interest (Aitkin & Longford, 1986; Goldstein & McDonald, 1988). As the parent data can be viewed as having three levels (facility, individuals, and time), we used the multilevel model allowing for random effects by facility and individuals instead of using the generalized estimating equation approach that does not incorporate the random effects.

This study has several limitations of a secondary data analysis. Since data collection consisted of 12 observations conducted in a short period, the long-term effect of environment was not examined. Further research using longitudinal data would be needed to examine the sustained effect of an engaging environment upon psychological well-being over time. Due to the nonrandom nature of the study, investigators were not able to examine any causal relationship but were able to show the association between quality of environment and psychological well-being. A future study to evaluate the potentially synergistic effect of the environment and personality upon emotional well-being is warranted. Additionally, researchers used observers' perspective of quality of environment to capture participants' ambiance. In order to maintain reliability, this was appropriate to assess participants' perception of environment because 87% of participants in this study had moderate to severe dementia.

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Conclusions

This study offers important clinical implications for long-term care clinicians and administrators. Findings suggest that an engaging environment is an important consideration when planning and providing care to persons with dementia. An environment that is relevant and interesting may promote a sense of well-being and support resident-centered care.

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Acknowledgments

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Please gray-box Clinical Resources

Heading level 1:

Clinical Resources

- Alzheimer's Association. <http://www.alz.org/>
- Alzheimer's Disease International. <http://www.alz.co.uk/>
- Alzheimer's Society. <https://www.alzheimers.org.uk/>
- IDEAS Institute. <http://www.ideasinstitute.org/about.asp>

Heading level 2:

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