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Research Article

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The Association Between Characteristics of Care Environments and Apathy in Residents With Dementia in Long-term Care Facilities

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Purpose: Apathy is highly prevalent in dementia but often overlooked. Environment-based interventions have demonstrated positive impact on apathy, yet, influential environmental components are largely understudied. This study examined the relationship between care environments and apathy in long-term care residents with dementia.
Design and Methods: This study was exploratory and employed a descriptive and repeated observation design. A sample of 40 was selected from a parent study with 185 participants from 28 facilities. Three videos from each participant were coded to measure apathy and environmental stimulation. Data on ambiance, crowding, staff familiarity, light, and sounds were extracted from the parent study. Generalized linear mixed models were used for analysis.
Results: The clarity and strength of environmental stimulation were significantly associated with a lower apathy level. An increase of 1 point on stimulation clarity and strength corresponded to a decrease of 1.3 and 1.9 points on apathy score, respectively ($p < .0001$). Other environmental factors did not show significant effect on apathy.
Implications: This study explored influential environmental features on apathy in dementia. Findings suggest that care environments that contain clear and sufficient environmental stimulation are significantly associated with lower resident apathy levels. Findings will guide environmental design and interventions for dementia care.

Key Words: Alzheimer's disease, Assisted living, Neuropsychiatric symptoms, Nursing homes,

Apathy is a highly prevalent neuropsychiatric and behavioral symptom in persons with dementia and can occur in all types and all stages of dementia (Hölttä et al., 2012; Starkstein, Ingram, Garau, & Mizrahi, 2005). Conceptually, Marin (1996) first defined apathy as primarily a motivation deficit demonstrated by a lack of goal-directed activities in cognitive, behavioral, and affective dimensions. Clinically, apathy manifests as lack of interest, lack of initiative, lack of response to environmental stimulation, social withdrawal, and flat emotional response (Robert et al., 2009;

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Starkstein & Leentjens, 2008). Apathy is associated with adverse consequences in persons with dementia, including advancement of dementia, reduced function in activities of daily life, and decreased quality of life (Holtta et al., 2012; Samus et al., 2005; Starkstein et al., 2005). Apathy is also associated with increased burden and increased risks of depression in family caregivers (Landes, Sperry, Strauss, & Geldmacher, 2001). Despite the negative impact of apathy, persons with apathy are often not well identified and do not receive appropriate care (Starkstein et al., 2005). More research is needed to help in understanding apathy and guide clinical assessment and treatment.

The importance of environmental factors in understanding apathy was pointed out by major pioneer researchers in apathy. Marin (1996) suggested that environmental events, such as being institutionalized, which lead to loss of incentive, reward, or control, are a precursor to apathy. Additionally, Strauss and Sperry (2002) described apathy as lack of responsiveness to internal or external stimuli demonstrated by a lack of self-initiated activity. The most recently suggested diagnostic criteria for apathy, proposed by a panel of experts, also includes a lack of response to environmental stimulation (Robert et al., 2009). A large study of 1,289 long-term care residents, which examined the environmental correlates of different neuropsychiatric symptoms in dementia, revealed that residents residing in care units with more staff and nursing time per resident showed less apathy (Zuidema, de Jonghe, Verhey, & Koopmans, 2010). This study suggests that individuals' internal factors alone are insufficient to explain apathy.

From an intervention point of view, literature suggests that physical and social environments play a crucial role in nonpharmacological interventions for behavioral symptoms in dementia (Algase, Beattie, Antonakos, Beel-Bates, & Yao, 2010). For apathy specifically, several interventions involving environmental stimulation have been shown to reduce apathy in patients with dementia, including multisensory stimulation (Baker et al., 2001), social interaction (Dettmore, Kolanowski, & Boustani, 2009), and music therapy (Holmes, Knights, Dean, Hodkinson, & Hopkins, 2006).

Environmental factors are especially important given that they are often easier to modify than many internal factors associated with aging and dementia. From a broader perspective, there is widespread interest in the concept of person–environment fit and its relationship to aging well (Wahl, Iwarsson, & Oswald, 2012). However, we know little about which components of physical and social environments influence apathy most effectively. Studies about care environments for neuropsychiatric symptoms of dementia either have not addressed apathy (Algase et al., 2010), or have only tested very limited environmental variables (Zuidema et al., 2010). Altogether, it is necessary to investigate how care environment impacts apathy in order to guide clinical practice for dementia care.

Theoretical Framework

The theoretical underpinning of this study is the need-driven dementia-compromised behavior (NDB) model (Algase et al., 1996; Algase et al., 2012) incorporated with the concept of apathy. In the NDB model (Figure 1), behavioral symptoms in dementia are conceptualized as NDBs, and resulting from background factors (e.g., personal underlying health and neurocognitive conditions) and proximal factors (e.g., personal needs and external environment). This highlights the association between environmental factors, including physical and social environments, and behavioral symptoms in dementia. Additionally, while background factors are considered static, proximal factors are dynamic and have the potential for immediate change.

Although the NDB model has not been explicitly examined for apathy, it is consistent with the concept

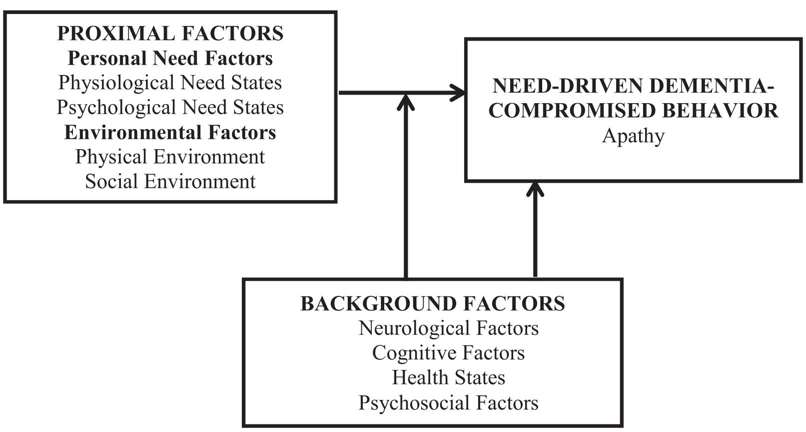

Figure 1. Need-driven dementia-compromised behavior (NDB) model.

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and mechanism of apathy described in the literature, especially the link between environments and apathy. Unresponsiveness to environmental stimulation is part of the diagnostic criteria for apathy (Robert et al., 2009). Marin (1990) suggests that environmental events can be a precursor to apathy when they result in loss of incentive or control. Additionally, according to Levy and Dubois (2006), the process of goal-directed behaviors is initiated by internal and external determinants, and followed with a cyclic process from intention, planning, and action, to outcome evaluation. Any dysfunction in this process will result in apathy. Environmental factors could be considered external determinants of this mechanism that could prompt goal-directed behaviors or possibly block the cycle for goal-directed behavior and consequently result in apathy.

Our selection of environmental variables was driven by these theoretical considerations. The parent study from which we selected samples is one of the pioneer studies proposing the NDB model (Algase et al., 2010). Most environmental data used in this study, including ambiance, crowding, staff familiarity, and light and sounds, were directly extracted from the parent study used to test the NDB model. To explore additional environmental factors that possibly influence apathy, we added environmental stimulation variables. The six characteristics on environmental stimulation were designed to capture possible factors affecting the process of goal-directed behavior (Levy & Dubois, 2006). Specifically, stimulation clarity, stimulation strength, stimulation specificity, and interaction involvement may influence individuals' intention. Physical accessibility may affect ones' planning and action. Environmental feedback may affect their goal outcomes and evaluation.

Research Purpose

The purpose of this study was to examine the relationship between environmental characteristics and apathy in long-term care residents with dementia. The environmental factors selected in this study included:

1. Environmental stimulation: stimulation clarity, stimulation strength, stimulation specificity, interaction involvement, physical accessibility, and environmental feedback.
2. Ambiance: engaging and soothing.
3. Crowding: number of people within 2 feet, 4 feet, 6 feet, and 8 feet.
4. Staff familiarity: how well the caregiver knew the participant, how long the caregiver had known the participant, and how often the caregiver had directly cared for the participant.
5. Light and sounds: low, moderate, and high level.

Methods

Design, Setting, and Sample

This study employed a descriptive and repeated observation design to examine the relationship between apathy and physical and social environments in persons with dementia. The sample was selected from a large observational parent study of dementia (Algase et al., 2011).

The parent study recruited 185 participants from 22 nursing homes and 6 assisted living facilities in Michigan and Pennsylvania from 2000 to 2004. The study facilities were selected based on convenience as well as gender and racial diversity. Participants were included in the parent study based on the following criteria: (a) were English speaking, (b) met Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition diagnostic criteria of dementia, (c) scored < 24 for Mini-Mental State Examination (MMSE), (d) were ambulatory, and (e) maintained a stable regime of psychotropic medications. For each participant, 14 videos were made to capture their dementia-related behavioral symptoms. Twelve of the videos were recorded between 8:00 a.m. and 8:00 p.m. during nonmealtime periods on at least two different days separated by 48 hr. The other two videos recorded specific events: one mealtime and one care event (e.g., bathing or dressing). Each video lasted 20 min. In total, there were 2,520 videos in the parent study.

The sampling procedure for this study is summarized in Figure 2. First, 40 participants were randomly selected using a random sequence generator. To be eligible, each participant had to have at least nine videos available. Of the 185 participants in the parent study, 172 who met the criteria were included in the selection pool. For each selected participant, three eligible videos and three segments from each video were selected.

Of the three selected videos, one was a recording of a mealtime, one recorded an interpersonal interaction between the participant and staff, and one was randomly selected. The variety of video samples, including the randomly selected video for each participant, allowed more representative data regarding participants' apathy and their exposure to their physical and social environments. In each 20-min video, we selected three 1- to 2-min segments of a stable environmental context, meaning that there was no room change, no new person joining the room, and no new interaction. The minimum time of 1 min for each video segment was selected because the findings of our pilot study showed that participants often responded within 1 min after stimulation, if they responded at all. Their responses typically did not change after 1 min. The selected video segments also had to contain high quality recordings of the participant's facial expression, voice, and front of the upper body, as well as the images and sounds of their immediate

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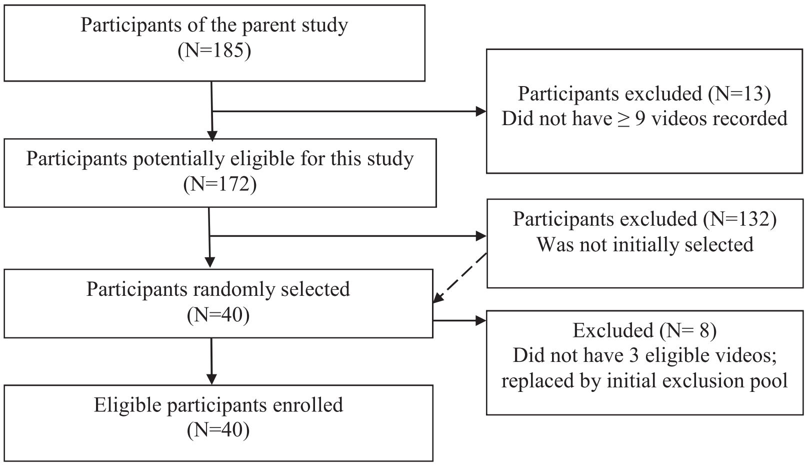

Figure 2. Sample selection procedures.

environment. Videos recorded during bedtime or naptime were eliminated. If an initially selected participant did not have sufficient eligible videos, a replacement was randomly reselected from the previously unselected pool until all eligible samples were identified.

Study Variables

Background factors

Background factors were collected to describe participants' baseline conditions, which included age, gender, race, facility type, cognitive function, and dementia-related deficits. Cognitive function was measured using the MMSE. Dementia-related deficits included learning and retaining information, handling complex tasks, reasoning ability, spatial ability and orientation, language, and behaviors.

NDB: apathy

Apathy levels were dependent variables of this study and they were measured using the Person-Environment Apathy Rating (PEAR)-Apathy subscale (Jao et al., 2013). The PEAR-Apathy is a part of the PEAR scale recently developed by Y.-L. Jao. This scale aims to assess apathy level through observation of persons with dementia across different stages. The PEAR consists of six items: facial expression, eye contact, physical engagement, purposeful activity, verbal tone, and verbal expression. Each item is rated on a 1–4 scale with a higher score indicating a higher apathy level (Jao et al., 2013). The content validity of the PEAR scale was established by a panel of dementia researchers. The PEAR-Apathy also demonstrates good convergent validity as evaluated by the Neuropsychiatric Inventory (NPI)-Apathy subscale (Cummings et al., 1994) and the Passivity in Dementia Scale (Colling, 2000) with a correlation of $\rho = .710$ ($p < .001$) and $\rho = .814$ ($p < .001$), respectively. The PEAR-Apathy also shows fair validity in discriminating apathy from depression with a correlation of $\rho = .462$ ($p < .001$) with the NPI-Depression subscale. Notably, the discriminate validity of the PEAR-Apathy is better than the Passivity in Dementia Scale ($\rho = .581$, $p < .001$) and the NPI-Apathy ($\rho = .614$, $p < .001$). For reliability, its Cronbach's α was 0.85, suggesting good internal consistency. The weighted Kappa of individual items ranged 0.47–0.86 and 0.74–0.89 for inter-rater and intra-rater reliability, respectively (Jao, 2014).

Proximal factors: environment

Environmental variables were the independent variables of this study. They included: environmental stimulation, ambiance, crowding, staff familiarity, and light and sounds.

Environmental stimulation

Environmental stimulation was measured using the environment subscale of the PEAR scale (The PEAR-Environment). The PEAR-Environment aims to assess the quality of environmental stimulation relevant to apathy in persons with dementia. Environmental stimulation broadly refers to any events, active objects, and people present that possibly trigger cognitive, behavioral, or affective responses from the participant. It can be sensory, physical, or social stimulation, such as a meal, a TV show, a staff member, or a conversation.

The PEAR-Environment includes six items: stimulation clarity, stimulation strength, stimulation specificity, interaction involvement, physical accessibility, and environmental feedback. Each item is rated on a 1–4 scale with a higher rating indicating a better environment (Jao et al., 2014). Stimulation clarity indicates the degree that the stimulation is exhibited discernible, straightforward, and well-guided manner with no competing stimuli (e.g., a well-guided activity program conducted

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in a quiet living room versus multiple competing and disorganized stimuli in a chaotic living room without a discernible stimulus toward the participant). Stimulation strength indicates the degrees to which the stimulation is loud, novel, interesting, and surprising versus a quiet room with nothing going on. Stimulus specificity refers to the level that any stimulation is specifically delivered and related to the participant. Interaction involvement describes the extent that any stimulation interacts with the participant. Physical accessibility indicates the degree to which the participant is capable of accessing the stimulation. Finally, environmental feedback refers to people's feedback responding to the participant's engagement and expression, ranging from restrictive, inattentive, to attentive, and prompting.

There are few comparable scales that allow full evaluation of PEAR-Environment. The Crowding Index (Algase et al., 2011) that consists of some similar constructs as the PEAR-Environment was used as a preliminary step to validate this scale. The Crowding Index shows low, but significant, correlation with the PEAR-Environment total score ($\rho = .266$, $p = .009$) and three of the individual scores, including stimulation specificity ($\rho = .301$, $p = .003$), interaction involvement ($\rho = .322$, $p = .001$), and physical accessibility ($\rho = .348$, $p = .001$), but not with stimulation clarity, stimulation strength, and environmental feedback (Jao, 2014). These results were not unexpected because the crowding index only covers a partial construct of the PEAR Environment. The PEAR Environment subscale captures stimulation broadly not only from people but also from ongoing events and objects. Also, it is understandable that when there are more people in the room or people closer to the participant, the environment is more likely to have accessible stimulation, stimulation specifically delivered toward the participant, or interactions involving the participant. However, it is not necessarily associated with how clear or how strong the stimulation is or the quality of environmental feedback.

For reliability of the PEAR-Environment, its weighted Kappa for inter-rater reliability was 0.49–0.94 (74.0–89.6% percent agreement) and for intra-rater reliability was 0.63–0.94 (79.2–92.7% percent agreement) suggesting good to excellent reliability. The total Cronbach's α was 0.84, suggesting good internal consistency.

Ambiance

Ambiance was measured in the parent study using the modified Ambiance Scale (Algase et al., 2007). The Ambiance Scale aims to assess long-term care facilities for their affective quality and consequently to assess the capacity of care environments for triggering behavioral and affective symptoms in residents with dementia. The psychometrics of the Ambiance Scale was examined in the parent study and reported favorable validity and reliability elsewhere.

The Ambiance Scale includes nine adjective pairs, categorized into engaging and soothing subscales. The engaging subscale includes six items: stimulating–custodial, warm–cold, embellished–stark, welcoming–impersonal, colorful–drab, and novel–boring. The soothing subscale includes three items: informal–formal, unpretentious–pretentious, and peaceful–chaotic. The Ambiance Scale was rated via direct observation by trained researchers at the end of each video recording. The researchers rated each item based on their impression for the environments through direct observation. Each item was rated on a −2 to +2 scale (Algase et al., 2007). This study analyzed the average engaging and soothing score (ranged −2 to +2) separately.

Crowding

The measure of crowding was developed in the parent study to assess the density and proximity of people surrounding the participant and its construct validity had been established (Algase et al., 2011). The measure of crowding consisted of a schematic diagram of five concentric circles, where (a) the center represented the participant, and (b) upon which a researcher placed an X to represent every person and the location of each individual present in relation to the location of the participant. The researchers were trained to identify distance of crowding from the participant using the fixed distance between the participant and research camera as the reference. The five circles, from inside (zone 1) to outside (zone 5), indicate a radius of 1 feet, 2 feet, 4 feet, 6, feet, and 8 feet from the participant, respectively. The total number of people within 2 feet, 4 feet, 6 feet, and 8 feet were calculated for analysis to indicate crowding.

Staff familiarity

Staff familiarity is described as how well the direct caregivers knew the participant (Kolanowski et al., 1994), and was measured in the parent study using three staff-reported indicators: (a) how well the caregiver knew the participant, (b) how long the caregiver had known the participant, and (c) how often the caregiver had cared for the participant, rated on a 1–4, 1–6, and 1–5 Likert scale, respectively. A higher index indicates a higher familiarity.

Light and sounds

The light and sound levels were measured in the parent study using Gossen Color Pro 3F Meter® (Bogen Photo Corp, Ramsey, NJ) and the Quest Sound Meter® (Quest Technologies, Oconomowoc, WI), respectively. Because the light and sound data were in a skew pattern and had outliers, the data were collapsed into three groups based

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on percentiles to indicate low, moderate, and high light and sound level separately. For light, the cutoff points for the three groups were ≤74, 75 to ≤170, and >170 lux. For sounds, the groups were ≤62, 62.1 to ≤68.1, and >68.1dBs.

Data Collection Procedures

Data were collected using two methods: (a) data extraction from the parent study, and (b) video coding in this study. Data extracted from the parent study included: background factors, including age, gender, race, facility type, and cognitive level and several environmental factors, including ambiance, crowding, staff familiarity, and light and sounds. In the parent study, data on background factors were collected via chart review. Staff familiarity was collected via a staff questionnaire. Ambiance and crowding were measured via researchers' direct observation. Light and sounds were directly measured by the researchers.

Data collected via video coding in this study were: apathy and environmental stimulation using the PEAR-Apathy and Environment subscales. Coding was conducted by two trained researchers after establishing inter-rater reliability. All video segments were randomly assigned to one of the researchers. To avoid bias, the two coding researchers were not involved in sampling or analysis. For each video, apathy and environmental stimulation were not coded by the same researcher. The rating order was prearranged and videos from the same participant were not arranged in sequence. The Institutional Review Boards (IRBs) granted permission to conduct this study.

The timing of data collection was different for each variable. In the parent study, all data on background factors were collected once for each participant. Staff familiarity data were collected once per video recording. Crowding, light, and sound data were collected three times for each video: (a) the beginning, (b) the 10-min mark, and (c) the end. In this study, apathy and environment stimulation were specifically coded for the time of the selected video segments. Because crowding, light and sound data could vary from time to time, matching the data to every video segment for apathy coding was important. We matched the data of crowding, light, and sounds using the following rule: the data at the beginning was used if the video segment started at 5-min mark or before, data at 10-min mark was used if the video segment started from after 5-min mark to 15-min mark, and data at the end was used if the video segment started after 15-min mark. Thus, the data were within 5 min from the beginning of the video segment for all video samples.

Data Analysis

Data analysis was conducted using the Statistical Package for the Social Science (SPSS 21, IBM Corporation, New York, NY) and Statistical Analysis Software (SAS 9, SAS Institute Inc., Cary, NC). The dependent variable was the total score of the PEAR-Apathy. Independent variables included: (a) the score of individual items of the PEAR Environment, (b) average engaging score and average soothing score of the Ambiance Scale, (c) number of people (crowding) within 2 feet, 4 feet, 6 feet, and 8 feet from the participant, (d) three separate scores on Staff Familiarity (how well the caregiver knew the participant and how long and how often the caregiver had provided care for the participant), and (e) light lux and sound decibels.

Descriptive statistics summarized participants' personal background conditions. For association between care environments and apathy, because this is a repeated measure study and there were nine video segments purposefully selected from three different videos for each participant, a generalized linear mixed (GLM) model was used to account for the correlation among videos on the same person and among segments within the same video. For the three videos, video 1 was at mealtime, video 2 contained interactions between staff and participant, and video 3 was a randomly selected video. Each set of independent variables was put in one GLM model to analyze their relationship to apathy. Because crowding data were drawn from a pool of people from within 2 feet to within 8 feet of the participant, the data began to overlap. Thus, each individual level of crowding data was analyzed in a separate GLM model rather than combined.

Next, we further performed model selection by using the Akaike Information Criterion (AIC) as a criterion for forward selection. To avoid collinearity, the environmental variables were separately analyzed in two groups: (a) environmental stimulation, and (b) ambiance, crowding, staff familiarity, and light and sounds. In each group, the model was checked for collinearity before interpretation. In the case that multicollinearity was encountered, variables were removed to alleviate the problem. Interaction models were also explored through introducing interaction terms between levels of cognitive impairment and each environmental variable.

Results

Sample Descriptive Statistics

This study included 40 participants with a total of 360 video segments. Tables 1 and 2 present the descriptive statistics of participant and environment characteristics for all samples together and for nursing home and assisted living samples separately. Participants' average age was 83 years, and the majority of participants were female (76%). The percentages reflect the national nursing home population in 2010, in which

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Table 1. Descriptive Statistics of Participant Characteristics (*N* = 40 Participants)

Characteristic	n (%)		
	All facilities (*N* = 40)	Nursing home (*N* = 26)	Assisted living (*N*=14)
Age, years, mean ± *SD* (range)	82.7 ± 6.3 (68–94)	83.6 ± 5.6 (74–94)	81.1 ± 7.4 (68–91)
Gender, female, (*N* = 38)	29 (76.3%)	20 (76.9%)	10 (71.4%)
Race, Caucasian, (*N* = 38)	32 (84.2%)	20 (76.9%)	14 (100%)
MMSE (*N* = 26), mean ± *SD* (range)	12.9 ± 6.5 (2–23)	11.9 ± 6.8 (2–21)	14.6 ± 6.0 (5–23)
Cognitive impairment level (*N* = 37/22/13)			
Mild[a]	9 (24.3%)	5 (20.8%)	4 (30.8%)
Moderate[b]	7 (18.9%)	4 (16.7%)	3 (23.1%)
Severe[c]	10 (27.0%)	7 (29.2%)	3 (23.1%)
Very severe[d]	11 (29.7%)	8 (33.3%)	3 (23.1%)
Dementia-related deficits (*N* = 35/21/12)			
Learning and retaining new information	35 (100%)	23 (100%)	12 (100%)
Handling complex tasks	30 (85.7%)	21 (91.3%)	9 (75.0%)
Reasoning ability	33 (94.3%)	22 (95.7%)	11 (91.7%)
Spatial ability and orientation	19 (54.3%)	14 (60.9%)	5 (41.7%)
Language	14 (40.0%)	8 (34.8%)	6 (50.0%)
Behavior	9 (25.7%)	6 (26.1%)	3 (25.0%)
Apathy, mean ± *SD* (range) (*N* = 360/216/126 video segments)	14.5 ± 4.3 (6–24)	14.5 ± 4.6 (6–24)	14.3 ± 3.9 (6–24)

[a]Mild = MMSE:17–23.
[b]Moderate = MMSE:11–16
[c]Severe = MMSE 0–10.
[d]Very severe = too severe to complete MMSE test.

Table 2. Descriptive Statistics of Environment Characteristics (*N* = 360 Video Segments)

Characteristic	Mean ± *SD* (range)		
	All facilities *N* = 360 segments	Nursing homes *N* = 234 segments	Assisted living *N* = 126 segments
Environmental stimulation	19.0 ± 2.4 (10–24)	18.7 ± 2.6 (10–24)	19.7 ± 1.8 (14–23)
Stimulation clarity	2.8 ± 1.0 (1–4)	2.7 ± 0.9 (1–4)	3.0 ± 1.0 (1–4)
Stimulation strength	2.8 ± 0.6 (1–4)	2.8 ± 0.7 (1–4)	3.0 ± 0.4 (1–4)
Stimulation specificity	3.0 ± 0.3 (2–4)	3.0 ± 0.4 (2–4)	3.1 ± 0.3 (2–4)
Interaction involvement	3.7 ± 0.7 (1–4)	3.6 ± 0.8 (1–4)	3.8 ± 0.4 (1–4)
Physical accessibility	3.9 ± 0.3 (2–4)	3.9 ± 0.4 (2–4)	4.0 ± 0.2 (2–4)
Environmental feedback	2.8 ± 0.6 (1–4)	2.7 ± 0.7 (1–4)	2.8 ± 0.6 (1–4)
Ambiance (*N* = 328/209/119)			
Engaging	0.7 ± 0.8 (−1.7 to 2.0)	0.6 ± 0.9 (−1.7 to 2.0)	0.9 ± 0.6 (−0.8 to 2.0)
Soothing	0.6 ± 0.6 (−1.0 to 2.0)	0.6 ± 0.7 (−1 to 2.0)	0.7 ± 0.5 (−0.3 to 1.7)
Crowding (*N* = 357/231/126)			
In 2 feet	0.9 ± 1.0 (0–5)	0.9 ± 1.0 (0–5)	1.0 ± 1.0 (0–4)
In 4 feet	1.3 ± 1.3 (0–7)	2.2 ± 1.8 (0–7)	1.2 ± 1.3 (0–5)
In 6 feet	3.3 ± 2.4 (0–12)	3.5 ± 2.4 (0–12)	3.2 ± 2.4(0–11)
In 8 feet	4.7 ± 3.2 (0–14)	5.0 ± 3.0 (0–12)	4.4 ± 3.3(0–14)
Staff familiarity (*N* = 351/228/123)			
Know well[a]	3.3 ± 0.7 (1–4)	3.2 ± 0.8 (1–4)	3.3 ± 0.6 (2–4)
Have known[b]	4.6 ± 1.3 (1–6)	4.6 ± 1.4 (1–6)	4.7 ± 1.2 (2–6)
Often care[c]	4.0 ± 1.4 (1–5)	3.9 ± 1.4 (1–5)	4.1 ± 1.2 (1–5)
Light and sounds (*N* = 357/231/126)			
Light	149.6 ± 155.1 (10–1800)	157.2 ± 138.2 ((10–1000)	135.7 ± 181.9 (12–1800)
Sounds	66.8 ± 10.0 (51.3–123.9)	68.0 ± 11.0 (51.3–123.9)	64.7 ± 7.5 (51.4–98.5)

[a]Know well = how well did caregiver know the participant.
[b]Have known = how long had the caregiver known the participant.
[c]Often care = how often did the caregiver know the participant.

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70% of the residents were aged 75 and over, and 67% of those were female (Harris-Kojetin, Sengupta, Park-Lee, & Valverde, 2013). Based on the MMSE results, more than half of the participants (57%) had severe to very severe cognitive impairment. The majority of participants showed cognitive deficits in learning, executive capacity to complete complex tasks, and reasoning. Among all video segments, the average apathy level of the sample was 14.5 (±4.3, 6–24) on a 6–24 scale, indicating a wide variety of apathy ranging from no apathy to high apathy. In our sample, 26 participants were institutionalized in nursing homes and 14 were in assisted living facilities.

For environmental stimulation, the average among all videos was 19.0 points (±2.4, 10–24) on a 6–24 scale. While the selected samples included a wide range of environments, they tend to be well-stimulated environments. Samples tended to have a very high score on interaction involvement and physical accessibility, with an average of 3.7 and 3.9, respectively, on a 1–4 scale. In terms of variety of the stimulation characteristics, the selected samples were very similar for stimulation specificity and physical accessibility, with a standard deviation of 0.3 on a 1–4 scale. The small variance of the sample may limit the power to detect the significance on their relationship with apathy. Regarding environmental ambiance, the average was 0.7 and 0.6, respectively, on a −2 to 2 scale for engaging and soothing subscales, indicating good affective quality for both characteristics. The average crowding surrounding the participant was 0.9 and 1.3 people within 2 feet and within 4 feet, respectively. The crowding increased to 3.3 and 4.7 people as the distance increased to within 6 feet and within 8 feet. Staff familiarity from staff self-reports was high on average. The light level was 150 lux on average with a wide variance from 10–1800 lux. The average sound level was 67 dB ranging from 51 to 124 dB.

Comparing samples from nursing homes and assisted living facilities, unsurprisingly, nursing home participants were slightly older and had lower cognitive function. However, both groups included participants across all levels of cognitive impairment, from mild to very severe levels. Notably, apathy levels in both groups were very similar. Regarding environmental characteristics, assisted living had slightly higher scores for environmental stimulation and engaging levels, whereas nursing home environments had slightly higher crowding and were brighter and louder. Staff familiarity levels in both types of settings were very similar. Overall, the differences between nursing homes and assisted living for participant and environment characteristics were subtle in our study sample and may not be sufficient to affect the results.

Association Between Apathy and Care Environments

A GLM model was used to analyze the relationships between apathy and each set of environmental factors for each individual, while accounting for the effect of different videos recorded at different times of day and under different environmental contexts.

Environmental stimulation

Among the six characteristics of environmental stimulation, stimulation clarity and stimulation strength were the only two significant factors affecting apathy scores (see Table 3). On average, an increase of 1 point in stimulation clarity corresponded to a decrease of 1.4 points in the apathy score ($p < .0001$). Similarly, an increase of 1 point in stimulation strength corresponded to a decrease of 1.9 points in the apathy score ($p < .001$). In contrast, stimulation specificity showed a negative effect on apathy with an increase of 1 point in stimulation specificity corresponding to 0.7 points higher in the apathy score ($p = .18$). Although it was not statistically significant, the effect size was relatively large. The other three factors, physical accessibility, interaction involvement, and environmental feedback, were not significantly associated with apathy levels. Findings also demonstrated that different environmental context from different videos did not significantly affect apathy levels.

In further analysis, the model selection that examined the main effect of the environmental stimulation yielded a model with environmental clarity, strength, and specificity. Environmental clarity and strength were associated with a lower apathy level, with an increase of 1 point corresponding to a decrease of 1.5 and 2.0 points on apathy score, respectively. The interaction model that introduced the interaction between cognitive impairment levels and each factor of environmental stimulation revealed similar results, and did not generate compelling evidence for preferring them over simpler main effects models. Notably, the results concerning environmental clarity, strength, and

Table 3. Relationship Between Environmental Stimulation and Apathy (N = 360 Video Segments)

Effect	Estimate	p
Intercept	22.76	<.0001
Video 1 mealtime	0.48	.31
Video 2 w/interaction	0.23	.66
Video 3 random	—	—
Stimulation clarity	−1.35	<.0001
Stimulation strength	−1.87	.0009
Stimulation specificity	0.70	.18
Interaction involvement	−0.37	.24
Physical accessibility	0.22	.75
Environmental feedback	−0.40	.22

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specificity appeared to be quite robust for modeling selection. That is, they were stable and did not change greatly in effect or evidence when different models were fit.

Ambiance, crowding, staff familiarity, light, and sounds
Ambiance, crowding, staff familiarity, light, and sounds did not show significant effects on apathy (see Tables 4–7). Furthermore, a model selection that explored these factors did not yield any significant main effect model or interaction model. Participant apathy levels were not significantly different across different videos with different environmental context and stimulation.

Among these factors, crowding within 2 feet was the only variable that approached statistical significance (p = .06). Specifically, an increase of one person present within the 2 feet radius from the participant corresponded to a 0.5 score higher in apathy levels but this effect became more subtle and less statistically significant as the persons got further away from the participant.

Table 4. Relationship Between Ambiance and Apathy (N = 360 Video Segments)

Effect	Estimate	p
Intercept	13.96	<.0001
Video 1 mealtime	0.54	.44
Video 2 w/interaction	0.41	.57
Video 3 random	—	—
Ambiance engaging score	−0.30	.53
Ambiance soothing score	0.49	.41

Table 5. Relationship Between Crowding in 2 Feet and Apathy (N = 360 Video Segments)

Effect	Estimate	p
Intercept	13.55	<.0001
Video 1 mealtime	0.41	.54
Video 2 w/interaction	0.60	.39
Video 3 random	—	—
Crowding in 2 feet	0.53	.06

Table 6. Relationship Between Staff Familiarity and Apathy (N = 360 Video Segments)

Effect	Estimate	p
Intercept	12.17	<.0001
Video 1 mealtime	0.68	.32
Video 2 w/interaction	0.53	.45
Video 3 random	—	—
Know well	−0.13	.79
Have known	0.39	.18
Often care	0.11	.66

Table 7. Relationship Between Light and Sounds and Apathy (N = 96 videos)

Effect	Estimate	p
Intercept	13.30	<.0001
Video 1 mealtime	0.63	.37
Video 2 w/interaction	0.30	.67
Video 3 random	—	—
Light low	1.07	.11
Light high	0.94	.17
Light moderate	—	—
Sounds low	−0.58	.35
Sounds high	−0.28	.66
Sounds moderate	—	—

For ambiance, neither engaging nor soothing scores of the environment affected participant apathy level. The effects of staff familiarity on apathy level were small and not statistically significant among all three indicators. In examining the direction of their effects, how well the caregiver knew the participant was associated with a lower apathy level while how long and how often had the caregiver cared for the participant tended to contribute to a higher apathy level.

Data on light and sounds were collapsed into three levels based on percentiles to indicate low, moderate, and high levels. Overall, the total effects across levels were not statistically associated with apathy level for both light (p = 0.22) and sounds (p = 0.42). In examining their effect at individual level separately, as compared to a moderate level, none of any particular light or sound level was significantly associated with apathy levels. Regarding light levels, participants in environments with darker or brighter than a moderate light level (75–170 lux) had an approximately one score higher on apathy. Although this effect was not statistically significant (p = .11 and .17, respectively), the effect size was relatively robust and may deserve further testing with a larger sample size.

Discussion

Overall, this study suggests that in long-term care facilities that provide clear and strong environmental stimulation, residents with dementia show significantly less apathy. In other words, individuals living in an environment that contains stimulation that is clear, well organized, and clearly guided, without overwhelming background noise or competing stimuli tend to have lower apathy levels. In contrast, those living in an environment with complicated and chaotic stimulation without a single discernible stimulus tends to have high apathy levels. For stimulation strength, individuals in an environment that contains a primary stimulus that is continuous, loud, interesting, or surprising tend to

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have lower apathy levels, while those in an environment with vague or not detectable stimulation tend to have higher apathy levels. Importantly, the PEAR-Environment does not measure how the stimulation presents to everyone in the room; rather, it specifically measures how the stimulation presents to the participant.

This study is one of a very small body of work that explores the association between care environments and apathy, which limits the comparison of our results with other studies. Our results for stimulation clarity and strength are consistent with some suggestions in the literature. Cutler (2007) reviewed literature on environments of assisted living and reported that, according to Hoglund and Ledewitz (1999), focused and appropriate stimulation is one important issue for dementia care facilities. They suggested that the care environment should aim to balance individuals' interest and curiosity, but not to introduce distraction and stress. Additionally, one recent intervention study revealed that persons with dementia, either apathetic or not apathetic, who were provided with stimuli that involved individual guidance and matched their interest, showed improved engagement duration; whereas those with unguided or uninterested stimuli did not show the improvement (Leone, Deudon, Paino, Robertm, & Dechamps, 2012). Our findings confirm the importance of stimulation clarity and strength tailored to individuals with dementia.

It seems understandable that a detectable and comprehensible stimulation is necessary for individuals before they can respond and interact with the stimulation. This also matches the literature on the mechanism of apathy. As mentioned by Levy and Dubois (2006), the process of goal-directed behaviors is initiated with internal or external determinants and individuals with any dysfunction in this process may result in a lack of goal-directed behaviors and apathy. Stimulation clarity and strength are especially essential for this population as their ability to discriminate between stimuli may be affected by the levels of decline in cognitive and sensory function associated with aging and dementia.

Interestingly, our results showed that while stimulation clarity and strength are associated with apathy, light, and sound levels are not. This finding suggests that absolute light and sound levels alone may not fully reflect stimulation clarity and strength for individual participants. In fact, a stimulus may be clear to one resident but unclear to another because of differences in hearing or visual abilities, or interest and relevance of the stimulation. The findings also point to the usefulness of PEAR in assessing care environments for apathy and dementia care. Currently, to our knowledge, there are no scales that explicitly measure care environments for apathy. The PEAR is also one of few scales which measures environments from a micro view (individual versus institutional level). The PEAR scale may be useful in future work that examines the relationship between care environments and apathy, and evaluates long-term care environments for dementia care.

Surprisingly, our study also found that stimulation specificity and crowding within 2 feet have some association with higher apathy levels, and the effect of crowding within 2 feet approached statistical significance. In other words, residents are more likely to be apathetic when they have people close by or experience individual interaction specifically directed at and tailored to them. The effects reported in our study are opposite to what we had anticipated. The reasons for this result are unclear and is worth further investigation. Also interestingly, our findings suggest that interaction involvement, environmental feedback, ambiance engaging level and staff familiarity do not have a significant effect on apathy. One large study with a sample of 1,289 participants that tested the environmental correlates of apathy revealed that when staff spent more time on care activities the residents were less apathetic (Zuidema et al., 2010). Our study did not show similar results. Other environmental factors which did not show significant effects on apathy include physical accessibility, soothing, crowding within 4, 6, or 8 feet, staff familiarity, light and sounds of the environments.

Although the effects of several environmental characteristics were small and/or not statistically significant, the tendencies we found in reducing or increasing apathy might be useful information for future studies. The environmental factors that corresponded with lower apathy were a high level of interaction involvement and environmental feedback, engaging level of ambiance, and more extensive caregiver knowledge of the resident. In contrast, environmental characteristics corresponding to higher apathy levels were stimulation specificity and accessibility of the environments, soothing level of ambiance, crowding (the closer the person, the stronger the effect), how often and how long caregivers had cared for the residents, and high or low levels of light (versus a moderate level). Although these factors did not show a significant relationship to apathy, it might be premature to eliminate them as potential correlates. The absence of a significant relationship with ambiance, crowding, staff familiarity as well as light and sounds might be partially explained by the fact that these data were extracted from the parent study, and the timing of measure may not exactly match the selected video segment. Future research to confirm these results would be helpful.

This study further suggests that people under different environmental contexts show slightly different apathy levels. Although the difference was not statistically significant,

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the findings were consistent among all GLM models. Interestingly, participants at mealtime or during one-on-one interactions with staff show slightly higher apathy levels, compared to randomly selected videos. One possible reason is that the environmental stimulation during mealtime and interaction with staff was usually strong and specific, and according to our results, specific stimulation tends to associate with a higher apathy level. Additionally, based on the design of the PEAR-Apathy scale, individuals were rated a higher apathy level when exposed to high quality stimulation (e.g., strong, specific stimulation) as compared to when exposed to poor quality stimulation (e.g., vague stimulation or stimulation not toward the participant) even if they demonstrated a similar response in the two situations. Future studies may compare apathy levels for people experiencing environmental stimulation versus no stimulation. This will require further analysis in larger studies in the future.

Some methodological limitations of this study may underestimate the effect of environmental features. First, the sample size of this study was relatively small. This prevented the incorporation of all environmental factors into the same model to examine individual factors, while controlling for the others. Secondly, except for environmental stimulation, most environmental data (i.e., ambiance, crowding, staff familiarity, and light and sounds) were extracted from the parent study which matched each selected video but did not necessarily match the exact segment selected for apathy measures. Yet, our approach to match data has helped minimize the timing gap between the environment measures and apathy measures. Thirdly, it is possible that the videos may not always offer the best angle from which to observe the participant's apathy level and the care environment. To overcome this limitation, we included three videos for each participant and clear inclusion criteria for each video. Finally, given that the parent study was conducted 10 years ago, the generalizability of this study might be decreased. However, our choice of participants reflects current demographics of national nursing home populations and the relationship between care environments and apathy is not likely to be dramatically changed over the past decade. Despite these limitations, using data and videos from the parent study made this study more feasible and cost-effective and allowed our study to explore multiple environmental factors.

Conclusions and Implications

This study is one of few studies that examine the relationship between care environments and apathy. Moreover, our study tested different environmental variables aiming for a more comprehensive approach. Overall, these findings shed light on our understanding of the effect of care environment on apathy and provide new directions for research and clinical practice to improve care environments for dementia to prevent or reduce apathy.

Theoretically, our findings on the effect of stimulation clarity and strength add evidence to support the NDB model for apathy, specifically the link between proximal factors (environments) and NDB (apathy). The findings also match the process of goal-directed behavior, regarding the link between external determinants (environments) and lack of goal-directed behavior (apathy). Clinically, this study points to the importance of creating care environments that provide clear and sufficiently strong stimulation for dementia care. Care environments, broadly speaking, include, but are not limited to, the structure design, room arrangement, care routine, activity program, and communication approach. Although other studies have tested the effects of different interventions on apathy, essentially environment-related interventions (e.g., music therapy), our study focuses on how activities are administered and adds evidence regarding the important components of care environments. Taken together, our study suggests that interventions that enhance instruction and match individual interest and functional level might be more effective in reducing apathy.

For research, future studies can further test environmental variables and examine potential interventions based on our findings. Possible interventions include tailored environmental stimulation. This study also introduces useful measures, especially the PEAR scale, to study care environments for apathy and dementia. The PEAR may also be a useful tool for studying other neurobehavioral symptoms of dementia. Based upon findings from our study, it would be useful to duplicate this study with larger samples using different research designs and testing this in clinical settings.

Clinically, our findings can be applied to environmental design, activity programs and communication in dementia care. Clinical education on environmental interventions to reduce apathy may help improve quality care for persons with dementia. For example, nursing home residents may be less apathetic and more engaged if the activities are novel and interesting, feature clear instructions and provide focused stimulation with limited distractions and extraneous stimuli. Staff training to enhance communication clarity and help staff knows how to provide strong enough environmental stimulation during care routines may also be beneficial to reduce apathy. The findings will also help evaluate clinical settings for dementia care. Notably, the stimulation clarity and strength need to be tailored to each individual's functional level and interests. By providing a properly stimulating environment, the ultimate goal is to reduce apathy, enhance a better person–environment fit, and improve person-centered care for persons with dementia.

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