

# **ENVIRONMENTAL MODIFICATIONS FOR DEMENTIA CARE**

A Thesis submitted to the faculty at Stanbridge University in partial fulfillment of the requirements for the degree of Master of Science in Occupational Therapy

By

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## Certification of Approval

I certify that I have read Environmental Modifications for Dementia Care by Jensen Allen, Joshua Caiquo, Morgan Sumner, and Ana Shor Tawil and in my opinion, this work meets the criteria for approving a thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Occupational Therapy at Stanbridge University.



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## Abstract

**Introduction:** A person's environment can support or obstruct their participation in important occupations, so occupational therapists often modify the physical environment during interventions. In the field of occupational therapy, working with individuals who have dementia is more common as the world population is living longer. As the symptoms of dementia progress, environmental interventions intend to support common challenges. These challenges include neuropsychiatric symptoms such as agitation, physical aggression, wandering, and screaming. This paper aimed to collect and organize effective environmental modifications to support professionals and care partners. Using articles reviewed during a literature review, we present an evidenced-based table to support the care delivered by both formal and informal care partners.

**Results:** Through our literature review we found music, physical adaptations, aromatherapy, and Montessori one on one activities were the main ways the environment can be used to shape occupational engagement. The effective environmental interventions were then connected to common challenges experienced by people living with dementia (PLWD). The evidence-based guide organizes the research to disseminate intervention ideas to decrease care partner burnout and increase quality of life for PLWD.

**Conclusion:** This literature review supports environmental interventions and care partner education. Our table serves as a tool to show how adapting the environment can help decrease negative symptoms of dementia, promote evidence-based practice to optimize occupational performance for PLWD, and decrease caregiver burnout.

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### **Environmental Modifications for Dementia Care**

The environment plays a large role in shaping the performance of occupations in all individuals, especially when it comes to dementia care. It is clearly included in the scope of occupational therapy (OT) which defines the environment as a wide array of interrelated variables that influence performance (American Occupational Therapy Association [AOTA], 2014a). Occupational therapists use the environment to increase or decrease activity demands; for example, they can decrease an activity demand by reducing background noise while providing verbal instruction. The human sensory system is located in the brain and is responsible for perceiving the environment and producing adaptive responses. According to Children's Hospital of Richmond (2016), a typically functioning brain generates adaptive responses, a response defined as "an action that responds to information from the environment in an appropriate and successful manner." In addition, if the sensory system in an individual is not adaptively responding, they still have the ability to problem solve. If it is too bright, people can squint or wear sunglasses. If it is too loud, people cover their ears or use ear plugs. However, when it comes to dementia, these adaptive responses begin to decline. As dementia progresses, the environment becomes an even greater factor in determining a person's successful occupational participation.

People living with dementia (PLWD) experience cognitive declines impacting skills required to create adaptive responses. Snow (2017) points to sudden or gradual changes in skills like visual perception, expressive and receptive language, gross and fine motor coordination, and orientation to people, place, time, and situations. Common barriers for PLWD include behavioral aggressiveness, restlessness, paranoia, wandering,

as well as structural changes, and caregiver challenges (Stewart et al., 2014).

Occupational therapy interventions mainly focus on three ways of addressing cognitive changes. First, there are interventions designed to establish, modify, and maintain activities of daily living (ADLs), instrumental activities of daily living, leisure, and social participation. Next, there are interventions designed to educate and support strategies for care partners to maintain their ability to continue in that role. Finally, there are environment-based interventions to improve behavior and perception and to reduce falls (AOTA, 2018). Our research focused on environment-based interventions for PLWD.

The sensory environment impacts occupational performance. Addressing an individual's unique senses—such as taste, vision, hearing, smell, and touch—personalizes an interaction, facilitating a client-centered and individualized approach. As multisensory stimulation focuses on an individual's senses, changing a person's environment can help increase or decrease their mood or behavior patterns, allowing them to communicate clearly and remain safe. To receive a diagnosis of dementia, at least two parts of the brain are actively dying, and this impacts both mood and behavior. The “snoezelen” room is a multisensory stimulation environment that demonstrates effective management of brain changes for PLWD. These rooms offer input to stimulate an individual's sympathetic or parasympathetic nervous systems (Maseda et al., 2014). In addition to multisensory environments, use of aromatherapy, music, lighting, and overall spatial layout of their environment impact engagement. Environmental interventions that target a person's sensations can support PLWD and improve their overall quality of life.

Through the expectations of our program we focused on leadership skills, incorporating OT material into our review, and plan to integrate what we learn into the



healthcare field. Our research considers the psychosocial aspects of care—specifically, how the environment impacts the way we engage in occupations. Based on our research, we created an evidence-based table to use as future occupational therapists. This table will also give formal and informal care partners accessible ideas to improve quality of life.

### **Statement of the Problem**

While there is research on dementia, there is a lack of knowledge around caregiving for dementia. Juckett et al. (2019) have highlighted that there is a 17-year gap in finding research and getting those findings implemented into the OT practice. Our hope was that our literature review narrowed that gap since our findings are within the past 10 years. In 2018, the AOTA published a table that assessed what interventions have strong evidence, and what interventions need further research, when it comes to caring for PLWD. This showed that there is success in the use of environmental modification for PLWD, but many modifications needed more or current research. For example, one intervention noted in this table as needing further research was Montessori Methods which was a modification that we focused on. By developing our evidence-based table, we hoped to support successful environmental modifications to prevent unnecessary suffering from symptoms of dementia. Through the research process, we realized there are many known environmental modifications that help in decreasing negative symptoms. So, our research focused on organizing these environmental modifications discussed in the literature into an easily accessible table with specific symptoms and possible solutions.

When an individual has dementia, they may present with difficulty communicating, problem solving, accepting a diagnosis, and may be reluctant to accept treatment (Mansfield et al., 2019). With these barriers, common symptoms include issues with repetitive behaviors, wandering, confusion, mood behaviors, and decreased attention. To address these barriers, research indicates there are both pharmacological and nonpharmacological interventions to compensate for the brain changes present with PLWD. Within the scope of nonpharmacological interventions, we focused on the promising research of environmental modifications.

We identified what types of environmental modifications have been found to be the most successful with common symptoms of dementia. Using this information, we created an evidenced-based table to support the care delivered by both formal and informal care partners. The older adult population has grown by 30.2% during the past decade (U.S. Census Bureau, 2019). Both leading national and international dementia advocates predict a large increase in people living with dementia due to many factors including longer life expectancy (Langa, 2018). As many people in the United States lack access to occupational therapists and remain untreated due to reimbursement challenges, creating an accessible evidence-based table will help both formal and informal care partners of PLWD to manage negative symptoms.

Through a literature review, we identified successful modifications for each symptom of dementia. Our goal was to highlight what specific environmental modifications have the most success with the negative symptoms of dementia, and to indicate what next steps will support the implementation of this table. Therefore, our PIO question was: What physical environmental modifications can be implemented in future

dementia care to reduce negative symptoms of dementia and decrease the chance of caregiver burnout?

### **Occupational Therapy Significance**

Through the scope of OT, dementia is influenced by all domains such as occupations, client factors, performance skills, performance patterns, and an individual's context and environment (AOTA, 2014b). The first domain affected by dementia is an individual's occupations. These include ADLs, social participation, and leisure. Under client factors, body functions such as mental and global mental function are affected most when a person has dementia. Under the domain of performance skills, this population also struggles with the ability to process information and socially interact with others. Within an individual's performance patterns, PLWD continue to value both their individual and societal roles as indicators of their quality of life (QOL). Finally, occupational therapists take into consideration their client's physical environment and analyze how it can be modified to increase independence and overall day to day function (AOTA, 2014b).

### **Literature Review**

Caregivers play a crucial role in the lives and care of patients with dementia. In the world of dementia care, there are both formal and informal caregivers, also known as care partners. Depending on several factors, including training and experience, care partners often experience moderate to severe burnout symptoms. Yildizhan et al. (2019) researched levels of burden and burnout in professional caregiving staff dealing with dementia patients. The researchers described burden and burnout as emotional exhaustion, depersonalization, and reduced personal accomplishment. The results demonstrated that caregiving staff experienced increased levels of emotional exhaustion

and burnout as compared to individuals who are not caregivers of PLWD. Dementia can be exhausting and fatiguing for both the individual and all their care partners.

Environmental modifications benefit both PLWD and their care partners. Care partners, both formal and informal, demonstrate increased resilience to burnout with dementia specific training (Han et al., 2019). An easy-to-use table of environmental modifications may help alleviate some negative symptoms of dementia like agitation, sleep disturbances, cognitive impairment, and depressive symptoms. These negative symptoms often increase burnout, so managing them helps to alleviate the experience of burden on the caregiver (Wein-Chen et al., 2012).

Several environmental modifications can support occupational performance and help reduce caregiver burnout, such as musical interventions, Montessori one-on-one activities, home or built modifications, and aromatherapy. For example, music interventions have been found to lead to improvements in caregivers' psychological stress, burden, and quality of life (Särkämö et al., 2013). Similarly, Montessori activities can help produce constructive interactions, increase interests and positive emotions, and therefore create a more pleasant experience for the family members and caregivers as well (Van der Ploeg et al., 2012). According to Struckmeyer and Pickens (2016) one of the reasons for care partners burnout is the lack of knowledge about environmental modifications. Therefore, understanding the best environmental modifications for common symptoms of PLWD can help give care partners the tools to best support PLWD.

**Montessori Method**

In the Montessori method, the environment is used to promote engagement in activities. For example, a caregiver can place a stack of dishes, cups, utensils, and napkins on a table to encourage PLWD to set the table. Another example could be to leave various materials in an accessible location to help with folding laundry. In these ways, care partners can tailor the environment to fit the needs and capabilities of PLWD. They can help assist with the use of time by organizing a balance of activities between self-care, leisure, rest, and productivity. Montessori interventions help provide personalized stimulation, meaningful activity, and engagement for people with dementia (Van der Ploeg et al., 2012).

When using the Montessori principles, care partners conduct activities that include the individuals interests and hobbies such as music, pictures, gardening, and woodwork. Once the care partner is aware of their preferred activities, they can gather supplies to provide access to engaging in their meaningful activity. In one study, the intervention showed success in reducing agitated behaviors, promoted positive affect, and promoted constructive engagement in participants living with mild, moderate, and severe stages of dementia (Van der Ploeg et al., 2012). This study found Montessori interventions to be more effective in this study in reducing agitation levels in participants who had lost fluency in their language in comparison to individuals who did not. Montessori interventions are easily adapted to everyone's preferences and interests, which makes it a promising intervention to be administered in a variety of settings and to a wide range of PLWD.

In a systematic review looking at the effectiveness of Montessori-based activities on cognition, eating, engagement and affect, similar results were found (Sheppard et al., 2015). The review suggested that Montessori interventions heightened constructive engagement, reduced passive engagement, and promoted a more positive affect in PLWD. These findings were consistent with the study discussed previously but this study also investigated two additional factors—eating behaviors and cognition. When looking at eating behaviors, the findings indicated that Montessori interventions promoted self-feeding behaviors and showed a reduction in eating difficulties. Benefits appeared to be specific to lower-level cognitive abilities including memory and attention.

### **Multisensory Environment**

Similar to the Montessori method and built environments, multisensory environments also engage the individual using their surrounding environment. A study was conducted to see if a multisensory stimulation environment had more of an effect regarding mood and behavior as compared with one-to-one activities in people living with dementia. Multisensory stimulation environments such as the Snoezelen room showed significant improvements in speech, relating to others, attentiveness, and overall mood (Maseda et al., 2014). The one-to-one activity group in the study also showed improvements in overall mood, improvements in speech, decreased confusion, relating to others, and attentiveness. There were no significant differences between the 2 intervention groups, suggesting they can both be used for mood and behavior improvements in PLWD.

**Music Therapy**

Music therapy is another successful environmental intervention that indicated improvements in negative symptoms in individuals with dementia. Moreover, music interventions can have cognitive, behavioral, and psychosocial benefits (Skingley, 2020). An intervention was designed that involved creating a multisensory environment that included instruments to make music. This led to improvements in active communication in verbal and nonverbal ways, creating positive social interaction in late-stage dementia participants (Clare et al., 2019). The intervention was done in a group setting as well as one-on-one interactions, further supporting the benefits of one-to-one interactions with this population. Benefits were also seen in groups that listened and participated in singing music as well. When performed regularly with familiar music, musical group therapy was successful in reducing behaviors such as agitation (Craig, 2014). Both listening to music and singing were found to enhance cognition, mood, episodic memory, orientation, attention, and executive functioning (Särkämö et al., 2013). Music is a cost-effective intervention that can be applied in a variety of settings and can be done by individuals on their own time.

**Aromatherapy**

Another environmental modification that showed success in alleviating some symptoms of dementia was aromatherapy. Aromatherapy is an environmental modification that can help improve behavioral and psychological symptoms. This is an effective environmental modification because it is a nonpharmacological intervention that has no serious adverse effects (Press-Sandler et al., 2016). Lemon, rosemary, lavender, and orange essential oils placed on a diffuser helped improve cognitive function in

patients with dementia (Jimbo et al., 2009). Moreover, inhaling aromas while sleeping helped improve sleep disturbances in individuals (Takeda et al., 2017). Aromatherapy was also shown to decrease agitation and improve mood in depressed patients (Yang et al., 2016). Press-Sandler et al. (2016) determined that when the olfactory system is stimulated from either spraying or diffusing the oils, participants within the studies received optimal results based on the location of the oils.

Aromatherapy has also been shown to decrease agitated behavior, depressive symptoms, and help improve personal orientation related to cognitive function. There have been multiple studies that have found that using essential oil can reduce agitation in severe cases of dementia. For instance, Press-Sandler (2016), mentions that when the oil was sprayed into a common living area unit for two hours a day over a 10-day period, less agitation within the group of clients that received this treatment was recorded. Another example of successful aromatherapy was a study done by Lin et al. (2011) where once a night for one hour lavender was sprayed via a machine. Applying aromatherapy this way helped the participants within this study increase sleep quality and significant reduced the participants' agitation scores, dysphoria scores, irritability scores, as well as their nighttime behavior scores.

### **Built Environment**

The physical or built environment of PLWD impacts the cognitive and behavioral symptoms that may arise. For example, it is common for PLWD to get confused about their topographical orientation. Some research on built environments indicates that the shape of a building impacts both confusion and escape type behaviors. Padilla et al. (2012) have highlighted that environmental changes like labeling, visual cues, barriers,



and organization are all possibilities to help orient PLWD to tasks they want to perform. Labeling can be done in many places. For example, if the individual is living in their own home, labeling cabinets, shower material, exits, and anything else can decrease an individual's confusion and help make day to day activities easier. If PLWD are in a community setting where they have neighbors and friends, labeling of exits where individuals live can also help decrease confusion and increase QOL. Having these visual cues can help make the individual and the caregiver feel less overwhelmed.

Another common symptom of dementia is wandering. When PLWD are not oriented to where they are, they can end up wandering around and being in places that are dangerous or that they should not be in. MacAndrew et al. (2017) found that using visual cues like labeling exits, putting bright tape on the floor, using physical barriers, or making it difficult to get to the exit can decrease wandering and leaving behaviors. Visual cues proved more effective than verbal cues from caregivers to decrease individuals from leaving.

As a care partner, the safety of PLWD is the highest priority. Visual cues will not only increase the safety for PLWD, but it will reduce the burden on the individual and their caregiver. Not having to worry about wandering or your patient leaving can take away some of the stress brought on by constant worry. All of these environmental modifications can be done at a low cost and without physically touching the individual.

A custom-built environment supports the safety of the individual while giving them independence. Some simple modifications include grab bars in the bathroom and shower, removal of rugs in the home, and temperature control of the water (Struckmeyer

& Pickens, 2016). These are low-cost changes to an individual's home that increases their safety and encourages independence while performing routine ADLs.

For PLWD, the spatial layout of their environment is another crucial part of home modifications that can either positively or negatively affect the individual's mood, behavior, and cognition (Marquardt et al., 2011). The removal of physical barriers such as furniture and clutter can also allow for better ambulation and decreased fall risks as their peripheral vision decreases. Increased independence with ambulation leads to less agitation and frustration while moving about their environment. Spatial reconfiguration, along with visual cues about their space, will aid in task orientation within the home environment.

Research supports basic design and reconfigurations for improving social abilities, functionality, and the well-being of these individuals (Marquardt et al., 2014). Caregivers benefit from being properly informed about the important environmental characteristics that impact PLWD in a positive manner. Environmental characteristics, specifically the spatial layout, often positively impact orientation abilities for PLWD.

### **Measures of Change**

To determine the effects of environmental modifications in PLWD, many measures are used. For example, the Touch Panel-type Dementia Assessment Scale is a computerized test designed to rate cognitive dysfunction quickly. Another study used the Japanese version of the Gottfried, Brane, Steen scale which measures the severity of dementia to understand the effects of aromatherapy in cognitive function (Jimbo et al., 2009). Menorah Park Engagement Scale rates engagement levels of PLWD (Sheppard et al., 2015). The Mini-Mental State Examination establishes the severity of dementia in the

individual, categorizing them as mild, moderate, or severe (Van der Ploeg et. al., 2012). Finally, the Cornell-Brown Scale measures the quality of life of the PLWD (Särkämö, 2013). Dementia is not a simple condition to measure and each of these tools can be used to develop data driven outcomes when determining the success of interventions involving the environment.

Identifying and describing the measures used to quantify changes in or the severity of the symptoms of dementia will prepare future researchers to test identified interventions. The tools listed above measure changes in emotional and behavioral difficulties, quality of life, cognitive functioning, engagement, and the severity of dementia. These measures are both valid and reliable to determine effectiveness of environmental modification interventions. We identified which specific environmental modifications are most successful in supporting occupational performance, dignity, and quality of life.

Many researchers have investigated different aspects of environmental modifications on dementia care. While these articles contributed to the research on environmental modifications, we used the knowledge to narrow down and categorize which modifications are the most successful for specific symptoms of PLWD. This led to an accessible table that all caregivers can implement to help increase occupational performance. Our research was focused on exploring how environmental modifications can reduce the negative symptoms, and therefore the improve the occupational performance, of PLWD.

### **Theoretical Framework**

We reviewed two different frames of reference that we found applicable to dementia care and environmental modifications. The two models that we looked at are the Person-Environment-Occupation (PEO) model and the Occupational Adaptations (OA) Model. PEO looks at three important concepts to consider when it comes to dementia care: the person, environment, and occupations. This model takes into consideration the strengths and weaknesses of the individual, the physical, social, and cultural aspects of the environment, and the daily activities the individual finds meaningful. Using this model will combine what the individual finds important, ways their environment is impacted, and adapt them to help the individual be as independent and fulfilled as possible.

The OA focuses on the interactive process between a person and their environment, and the adaptive process that happens when an individual engages in meaningful occupations (Cole & Tufano, 2020, p. 140). The OA frame of reference highlights the adaptation process when an individual encounters various challenges affecting their occupational performance. This frame of reference focuses on the person, the occupational environment, and the interaction between these two elements. When dealing with the person, this includes their cognition, sensorimotor skills, and their psychosocial system. When dealing with the environment, this includes work, play, leisure, and self-maintenance.

There are many similarities between the two models. First, they both take into consideration the occupations that the individual finds meaningful. This includes daily activities that the individual wants, needs, or must do. Examples include ADLs, leisure

activities, communication and relationships, and hobbies that the individual enjoys. The environment, which includes the individual's physical surroundings and social influences, is an important factor in both models. Finally, they both have a holistic approach when evaluating clients, and take into consideration the specific desires and needs of the individual.

While these models have many similar aspects, they have some differences as well. The OA model focuses more on the environmental modifications that the individual needs to be independent, while the PEO takes into consideration the components of the individual's environment but does not suggest interventions that involve environmental change. Next, the PEO model highlights a broader example of environmental factors—such as their values, interests, relationships, experiences, strengths and weaknesses—that affect the individual. The OA model reviews the occupational environment and how the individual and therapist can make direct changes to said environment. Lastly, OA evaluates the individual's interaction with their specific environments including ADLs, work, play, self-care, and leisure, while the PEO does not go as in depth. This leads us to conclude that OA would be the best fit for our literature review. It aims to evaluate the challenges faced by the individual living with dementia and provides feedback so care providers can adjust environmental modifications based on observable behaviors.

In the process of formulating, developing, and discussing our literature review, the OA model guided our research to focus specifically on physical modifications of the environment that individuals or caregivers can implement. For example, modifications may include visual presentation of the environment, types of sound or music, or even presentation of aromas. With the help of this model, we identified which modifications

address specific symptoms in PLWD. Using OA, we hoped to manage unnecessary stress from the environment and provide cognitive support to address emotional regulation and behavioral difficulties. In our research we saw a need for stimulation, memory aides, aromatherapy, spatial layout, and more. With the many aspects that the environment includes, the OA model kept our research focused on the physical environment and how we can adapt it to support dignity and quality of life for people living with dementia symptoms.

The OA model is the best fit for our research. Many articles from our review used an occupational adaptation model by highlighting how they have changed the environment rather than changing the individual. For example, the spatial layout, aromatherapy, music, etc. have all shown improvements in the quality of life and impairments for people living with dementia while focusing on adapting to the physical environment. Our research helps us exclude the social and cultural factors that might influence an individual's environment and narrows our focus on how the environment can change without direct contact with the individual.

### **Methodology**

Our methodology included several stages: identification, screening, eligibility, and finally the inclusion process for our literature review. The articles were identified through the databases ProQuest Nursing Allied Health Source, EBSCO Academic Search Complete, Google Scholar, and PubMed. When screening articles, we selected articles consistent with values of non-maleficence, autonomy, and veracity. The key words used to screen our articles included: environmental modifications, dementia care, aromatherapy, physical environment, non-pharmacological interventions, music therapy,

food modifications, sensory stimulation, wandering, spatial layout, and behavioral and cognitive impairments. The included articles were all peer reviewed and available in the full text form.

In addition to the literature review, we also participated in a professional webinar led by Elle Spence Lewis who is a media composer/producer working on audiovisual neurofeedback projects to understand how music impacts the brain. Although the articles read for the webinar are beyond the scope of this specific review, music remains one part of the environment that continues to impact mood and quality of life for people living with dementia.

For articles to be eligible for review, they had to be published within the past 15 years. Articles had to be focused on neurocognitive declines in connection to the environmental modifications for PLWD. We put an emphasis on articles that used environmental modifications not requiring physical contact between the caregiver and PLWD. For example, using articles that focus on diffuser aromatherapy instead of aromatherapy being applied to the skin or body.

### **Ethical and Legal Considerations**

The national code of ethics established by AOTA protects clients during interventions and guide occupational therapists in their research. As researchers performing a literature review, we applied the AOTA's Code of Ethics by considering only literature consistent with AOTA's Principles and Standards of Conduct which include nonmaleficence, autonomy, and veracity (AOTA, 2015). Nonmaleficence is an obligation to not impose risks of harm even if the potential risk is without malicious and harmful intent (AOTA, 2015, p. 3). We ensured that all studies used reduced the risk of

harm. We excluded any studies where participants experience pain or discomfort due to the intervention. Autonomy means practitioners have a duty to treat the client according to the client's desires, within the bounds of accepted standard of care, and to protect the client's confidential information (AOTA, 2015, p. 4). We confirmed information in the studies follows accepted privacy standards. Veracity is based on the virtues of truthfulness, candor, and honesty (AOTA, 2015, p. 6). We used studies with honest, straightforward, and truthful information about their intervention and ensured that all studies were published within the past 15 years. In addition, participants in these studies were fully aware of the process and all aspects of each study.

All the articles used followed accepted procedures, were comprehensive, and objective. When following accepted procedures, the studies went along with common trends and expectations of current research. For example, if a study was funded without transparency, if a subject was not informed of their rights, or if a study allowed subjects to suffer unnecessarily, we did not include them in our research. To be considered comprehensive the structures of the articles were clear, concise, and easy to understand. To be considered objective articles refrained from imposing their opinion or any biases about the population or study. Once the application was complete, we submitted it to the Stanbridge University Institutional Review Board to undergo an independent review of our research methods.

### **Results and Discussion**

PLWD experience behavioral and psychological symptoms, including memory, language, motor coordination, and cognition impairments. Often, the physical environment in which they live do not support the individual's needs, which can cause



more stress on the individual and their caregivers, leading to caregiver burnout.

Montessori one on one activities, music, aromatherapy, and built environments are all effective environmental modifications to help reduce negative symptoms of PLWD and caregiver burnout.

### **Montessori Method**

Montessori activities engages individuals in an environment adapted to support behavior, language, and memory. Montessori activities provide socialization, meaningful activity, and diversion through interaction and the unmet needs, and can easily be adapted to interests and skills of people (Van der Ploeg & O'Connor, 2010). PLWD may have difficulty communicating their needs for physical comfort, social engagement, and meaningful activity, which can result in behavioral and psychological symptoms (Mbakile-Mahlanza et al., 2020). Neuropsychiatric symptoms such as aggression, agitation, depression, anxiety, delusions, and apathy are commonly seen in PLWD. Montessori interventions help to alleviate these difficulties by bringing in former hobbies and interests of the individual including music, pictures, and activities. Recollection based occupational therapy has shown to be effective in PLWD, having familiar objects facilitate engagement in therapy (Kim, 2020). Long term memories in these individuals are normally well-preserved, so Montessori attempts to connect with those memories by providing familiar concepts from their lives (Huntsman, 2019). These activities are designed to tap procedural memory (which is normally better preserved than verbal), while providing external cues and minimizing language demands to compensate for cognitive deficits (Mbakile-Mahlanza et al., 2020). Since every individual with dementia

is going to present with different needs, Montessori activities provide hope for the best individualized care.

Participating in familiar activities has shown improvements in behavioral and psychological symptoms, in particular, agitation, interest, and engagement (Van der Ploeg et al., 2012; Chan et al., 2021; Mbakile-Mahlanza et al., 2020; Roberts et al., 2015). Montessori methods proved more effective in reducing agitation for participants who had lost fluency in speaking English, which is typically a symptom in the later stages of dementia. The improvements in engagement and decreases in agitation also have a positive effect on caregiver burden. Neuropsychiatric symptoms affect dementia patients nearly universally, and are associated with poor patient and caregiver outcomes, leading to caregiver stress (Fraker et al., 2014). Studies have shown that loved ones with dementia were more engaged with their caregivers during these activities, and overall showed an improved mood, which in turn improved family satisfaction (Roberts et al., 2015). Montessori methods both reduces behavioral and psychological symptoms of dementia and also increase the connection a person feels with their caregiver, which can help alleviate caregiver burden.

### **Music**

One of the modifiable environmental factors is music. It creates a multisensory experience with auditory, visual, and even tactile input. The use of music as a modifiable factor in the environment demonstrates improvements in verbal and nonverbal communication, social interaction, verbal fluency, reducing agitation, and caregiver distress (Clare et al., 2019). Further engagement with music by singing and listening to

music also supports improvements in enhanced cognition, orientation, attention, executive functioning, mood, and episodic memory (Sarkamo et al., 2013).

Music is processed throughout the brain, including the frontal and temporal lobes. In order to speak, the Broca's area typically needs to be functional. When singing along to a familiar song, this area of the brain is getting turned on and often results in temporary improvements in the ability to communicate wants and needs (Baird & Samson, 2015). Music has a tremendous effect on the brain, it causes both structural and functional changes which can in turn activate signaling in areas of the brain involved in emotional processing, attention, reward, and motivation (Sharma & Silbersweig, 2018).

Music therapy is effective for enhancing memory and language ability in patients with mild Alzheimer's disease and reducing the psychiatric symptoms and caregiver distress in patients with moderate or severe Alzheimer's disease. Despite a connection to improve underlying skills, no significant improvement was noted for the performance of activities of daily living in patients with mild, moderate, or severe Alzheimer's disease (Lyu et al., 2018). The most effective interventions using music involved live music groups or one-on-one sessions. Group music interventions showed reductions in agitated behavior, physical non-aggressive behavior, verbally non-aggressive behavior, and physically aggressive behavior (Lin et al., 2011). Group music therapy have also been shown to decrease depression in PLWD, both immediately after the start of the therapy and throughout the therapy (Chu et al., 2013). Moreover, music intervention in a group setting using percussion instruments with familiar music significantly reduced anxiety in PLWD (Sung et al., 2011). Participants got to play a wide variety of instruments and participate in sing-along groups. Participants also did music and singing groups which

can be led by music teachers or listening to CDs, which spark discussion about emotions, thoughts, and memories (Sarkamo et al., 2013).

### **Aromatherapy**

Aromatherapy is an environmental modification that has also been shown to decrease agitated behavior, improve depressive symptoms and enhance personal orientation related to cognitive function (Turten & Ozdemir, 2017). Aromatherapy can impact an individual's performance because of the close connection between the olfactory and the limbic system. The olfactory cortex has connections with limbic system structures including the amygdala, hippocampus, and hypothalamus (Scuteri et al., 2017). The amygdala is involved in forming emotional responses, particularly fear responses and memories, the hippocampus indexes and stores memories, and the hypothalamus regulates emotional responses. It is the limbic system that connects senses, such as odors, to our memories and emotions. The connection between the sense of smell and emotions is different because the olfactory nerves are the nerves of our senses that connect directly to the brain and odors can either have positive or negative emotions from certain scents (Press-Sandler et al., 2016).

Some examples of interventions are to place a sponge infused with six drops of lavender essential oils near an air humidifier for one hour in the client's room while sleeping daily for 4 weeks (Turten & Ozdemir, 2017). A study done by Takeda et al. (2017) put essential oils on a towel while the participants were sleeping. The essential oils used were true lavender, sweet orange blend, Japanese cypress, Virginian cedarwood, cypress, and pine oil blend. All three oils contained two or more of linalool, santalol, cedrol, and piperonal. Before the start of the study, each participant selected one oil

among the three used. The total sleep time was significantly longer for PLWD compared to the control group. The duration of the longest sustained sleep period was significantly longer as well. These results show promise that manipulating scent can positively impact sleep disturbance (Takeda et al., 2017). A second research study highlighted those essential oils in a diffuser showed improvement in personal orientation related to cognitive function after therapy (Jimbo, 2009). The participants were exposed to the aroma of 0.04 ml lemon and 0.08 ml rosemary essential oil in the morning for two hours and 0.08 ml lavender and 0.04 ml orange essential oils in the evenings for an hour and a half. The essential oils were placed on a diffuser with an electric fan, a method that can be easily implemented to the environment and can have a positive impact on PLWD.

### **Built Environment**

The final environmental modification is the built environment or environmental cues. Research has shown that the environment can have a great effect on an individual's brain. There is a strong correlation between brain plasticity and stimulating environments, showing that it can have positive effects on an individual's quality of life. Research also shows that having an enriched and stimulating environment can increase the release of neuromodulators that lead to an increase in learning and plasticity in an individual's brain (Sale et al., 2014). Allen et al. (2017) splits environmental modifications into four types: first, additive or adding labels to help with memory; second, subtractive, or taking away things such as clutter to decrease confusion and falls; third, behavioral, setting up the environment to promote individualism and success in activities; and fourth, transformative, or changing the aesthetic of the environment like lighting to decrease agitation or increase sleep. Taking these four categories into

consideration, researchers have shown many ways that caregivers of PLWD can adapt the environment to help improve quality of life and independence.

Research has also highlighted the use of environmental cues such as calendars, labeling of cabinets, and name plates can help decrease confusion and increase spatial awareness in people living with dementia. When observing participants, researchers observed less agitation and increased communication from PLWD (De Oliveira et al., 2010). Moreover, another intervention that worked was putting tape or mats on the floor around exits (Padilla et al., 2012). This type of environmental modification decreased exiting or attempts to exit for PLWD.

Other ways that the physical environment can be adjusted were decreasing clutter and opening the floor plan for individuals to help decrease the risk of falls. Marquardt et al. (2011) highlighted that 28% of their sample would use unstable objects such as furniture to help them navigate their home. This increases their chance of falls and makes it harder to move freely around their home in an effective way. Clearing pathways and adding assistance like hand railings and grab bars can help increase safety and independence in PLWD. In another study, Baurant et al. (2018) evaluated ways to decrease behavioral and psychological symptoms of dementia. These symptoms were described as agitation, physical aggression, wandering, and screaming. The environmental modifications that these researchers looked at were sky-like ceiling tiles, decreased lighting and soothing music from 6:00–8:00 p.m., increased light during the day, beige painted walls, and using oversized clocks. The results of these changes showed a decrease in BPSD, specifically highlighting improvements with sundowning or an increase in symptoms as the day goes on (Baurant et al., 2018).

The most effective changes to the environment have been found to be adding assistance with grab bars, handrails, and stair lifts. While decreasing clutter and moving furniture to open the floorplan was less common, it was still effective (Allen et al., 2017). While environmental modifications are effective, they are not a one size fits all and caregivers should have the proper education to figure out what will help their patient the most. Allen et al. (2017) highlighted barriers that prevented environmental modifications from being successful were lack of caregiver education, attempts to maintain familiarity, and using unreliable resources which is why research like this study are important to the future of dementia care.

Music creates a multisensory experience which is effective in improving communication and social interaction, while reducing psychiatric symptoms and caregiver distress in PLWD. Aromatherapy has been shown to improve depressive symptoms, decrease agitated behavior, and enhance personal orientation in PLWD. All through utilizing various essential oils and diffusing or spraying them into the air. Montessori activities engage individuals in previous familiar interests which has shown improvements in behavioral and psychological symptoms, in particular agitation, interest, and engagement. Finally, the physical environment can be adapted in many ways such as adding labels or physical cues, adapting the ambiance such as lighting or wall colors, restructuring the spatial layout, and many more. These have all proven to decrease agitation, wandering, confusion, aggression, and other negative symptoms that arise in PLWD. Adapting the physical environment and educating caregivers on how these changes can help manage symptoms of PLWD, is beneficial to the person living with dementia as well as helping to decrease caregiver burnout.

**Table 1**

Category	Alleviated Symptom	Environmental Modification	Outcome
<b>Behavioral</b>	<u>Agitation</u>	Music	Group music interventions; listening/singing music; playing instruments
		Aromatherapy	Diffuser with electric fan
		Built Environment	Spatial Layout: decreased lighting, beige walls, bright light therapy
		Montessori	Providing environmental set-up with access to items connected to former hobbies and interests including music, pictures, activities
	<u>Wandering/ Confusion</u>	Built Environment	Tape and signs by exits
			Labeling, name plates
	<u>Aggressiveness</u>	Music	Group music interventions
		Montessori	Bringing in former hobbies and interests including music, pictures, activities
	<u>Communication</u>	Home Built (receptive)	Name plates, labeling, calendars



		Music (expressive)	Group music interventions; Playing/listening to music
<b>Cognitive</b>	<u>Spatial/time orientation</u>	Aromatherapy	Aromatherapy inhalation was administered by placing a sponge infused with six drops of lavender essential oil at the outlet of a cool mist air humidifier
	<u>Attention</u>	Music	Playing instruments; singing and listening to music
	<u>Memory</u>	Music	Listening to familiar music (episodic vs procedural memory)
		Montessori	Familiar activities designed to tap procedural memory
	<u>Executive functioning</u>	Aromatherapy	Essential oils in a diffuser
<b>Psychosocial</b>	<u>Mood/affect</u>	Music	Singing and listening to music
	<u>Depressive symptoms</u>	Aromatherapy	Aromatherapy inhalation was administered by placing a sponge infused with six drops of lavender essential oil at the outlet of a cool mist air humidifier

		Music	Group music therapy
	<u>Anxiety</u>	Music	Music intervention in a group setting using percussion instruments with familiar music
<b>Other</b>	<u>Interest</u>	Montessori	Bringing in former hobbies and interests including music, pictures, activities
		Music	Singing and listening to music
	<u>Decreased strength and decreased balance</u>	Home Built	Grab bars, railings, decreasing clutter, stair lifts
	<u>Sleep disturbances</u>	Aromatherapy	Essential oils on a towel around head while sleeping
		Built environment	Calm aesthetic or lighting

### Possible Limitations

Possible limitations included personal biases, language limitations, and a small sample size. Our personal biases included how we interpreted the information from the articles. This could affect how we organized our research. Some of the articles that we reviewed had a very small sample size. Finally, we had a limited amount of time to conduct the literature review.

### **Conclusion**

The main takeaways from our literature review were that musical interventions, Montessori one-on-one activities, home and built modifications, and aromatherapy are the environmental modifications that have been found to have the biggest impact on improving dementia symptoms. The PIO question that guided our research was what physical environmental modifications can be implemented in future dementia care to reduce negative symptoms of dementia and decrease the chance of caregiver burnout? Environmental modifications demonstrated benefits for both PLWD and their care partners. An accessible table of environmental modifications organized negative symptoms of dementia like agitation, sleep disturbances, cognitive impairment, and depressive symptoms with the environmental modifications addressing these symptoms. We hope this table can be implemented into future care practices and help improve the overall quality of care for PLWD. Future research recommendations include educating caregivers on how to utilize the guide and reporting the impact it has on the lives of people involved in dementia care.

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