The Impact of a Multisensory Stimulation Environment within a Memory Care Assisted Living Facility

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THE IMPACT OF A MULTISENSORY STIMULATION ENVIRONMENT WITHIN A MEMORY CARE ASSISTED LIVING FACILITY

by

Dana M. Prince

A dissertation submitted to the Graduate College in partial fulfillment of the requirements for the degree of Doctor of Philosophy Interdisciplinary Health Sciences Western Michigan University December 2019

Doctoral Committee:

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Dana M. Prince
THE IMPACT OF A MULTISENSORY STIMULATION ENVIRONMENT WITHIN A MEMORY CARE ASSISTED LIVING FACILITY

Dana M. Prince, Ph.D.
Western Michigan University, 2019

The use of Multisensory Stimulation Environments (MSSE) has grown increasingly more common in the United States (U.S.) as a nonpharmacological intervention for Behavioral and Psychological Symptoms of Dementia (BPSD). However, typical MSSE designs require a secluded room isolated from outside stimulation and demand direct supervision from the care provider during treatment. Due to projected shortages in the clinical workforce and the population of older adults on the rise, a study was designed to reveal the effectiveness of an open-floorplan MSSE to reduce the demand of care providers during the use of the MSSE while allowing subjects diagnosed with dementia to utilize the space independently for treatment.

The aim of this study was to investigate whether an open-floorplan MSSE design impacted episodes of BPSD, prevalence of falls, and psychotropic medication use in older adults diagnosed with dementia living in a Memory Care Assisted Living (MCAL) facility. This study also explored the impact an MSSE on employee turnover and staff engagement for those working within the MCAL unit.

An all-inclusive sample of 24 residents over 65-years-old with a diagnosis of dementia and living in an MCAL facility located in a metropolitan area of a Midwest state in the U.S. were analyzed by secondary medical chart review for the pre/post implementation impact of an open-floorplan MSSE design on BPSD, the prevalence of falls, and psychotropic medication use. The
documented BPSD episodes, number of falls experienced by the MCAL residents, and the number of psychotropic medications administered were analyzed for a total of 6 months prior to the MSSE installation and 6 months following the MSSE installation. Additionally, a study population of 46 employees, staffed exclusively by the MCAL, was analyzed by turnover data and engagement survey results in this study.

Following the installation of the MSSE, the number of observed BPSD episodes changed from 17% pre-test to 10% post-test. Psychotropic dose reductions improved from 0% pre-test to 1.4% post-test. The employee turnover rate decreased from 41.8% pre-test to 12.9% post-test. In addition, the results revealed improvements in employee engagement outcomes and employee satisfaction measures.

The open-floorplan MSSE design utilized as a nonpharmacological intervention for BPSD was found to be effective in improving BPSD, psychotropic medication dose reductions, and employee turnover on the MCAL unit. Further analysis is recommended to determine impact of the open-floorplan MSSE on the administration of psychotropic medications and falls experienced by residents of an MCAL facility.
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CHAPTER I

INTRODUCTION

The population of older adults is continuously increasing with individuals 65 and older in the United States (U.S.), rising from 43 million in 2012 to nearly 84 million by 2050 (Ortman, Velkoff, & Hogan, 2014). Additionally, an estimated 4.75 million people with dementia existed in North America in 2015 with this population projected to climb to over 7 million by 2030 and nearly 12 million by 2050 (Alzheimer’s Disease International, 2015). Simultaneously, the U.S. is projected to experience a shortage of the clinical workforce, which will only intensify as the aging population (including cases of dementia diagnoses) grows along with a higher demand for specialized health care (Chenoweth, Jeon, Merlyn, & Brodaty, 2010; Rosseter, 2019). This dissertation is an exploration of the use of a nonpharmacological intervention to treat Behavioral and Psychological Symptoms of Dementia (BPSD) for residents with a diagnosis of dementia living in an Assisted Living Facility (ALF) that specializes in memory care, otherwise known as a Memory Care Assisted Living (MCAL) facility.

Types of Dementia

Individuals diagnosed with dementia may be categorized by any of the following conditions: Alzheimer’s disease, vascular dementia, Dementia with Lewy bodies (DLB), mixed dementia, Parkinson’s disease, Frontotemporal lobar degeneration (FTLD), Creutzfeldt-Jakob disease, normal pressure hydrocephalus, Huntington’s disease, and Wernicke-Korsakoff Syndrome (Alzheimer’s Association, 2017). Caring for older adults with these varying forms of dementia diagnoses
requires direct supervision by care providers. These providers may include relatives, hired private-duty caregivers, and personnel who work in long-term care facilities such as Assisted Living Facilities (ALF) and Skilled Nursing Facilities (SNF). Caregivers working in an ALF may be unlicensed personnel with specific training provided by the facility, a Certified Nursing Assistant (CNA), or a licensed nurse.

**Behavioral and Psychological Symptoms of Dementia**

Individuals diagnosed with dementia often display behavioral symptoms such as aggressiveness, wandering, depression, agitation, anxiety, repetitive activity, and nighttime disturbances. These are collectively referred to as Behavioral and Psychological Symptoms of Dementia (BPSD) (Alzheimer’s Association, 2017). A systematic review of observational studies reveal that persons diagnosed with dementia often experience BPSD due to sensory deprivation, particularly those who are institutionalized, and consequently often experience intra-psychic discomfort due to imbalances in sensory-stimulation (Sánchez, Millan-Calenti, Lorenzo-Lopez, & Maseda, 2013).

**Treatment and Intervention**

Psychotropic medications are frequently used for the management of BPSD in nursing homes, and these include antipsychotics, antidepressants, anxiolytics, and hypnotics (Ozaki, Katsumata, & Arai, 2018). However, in a study analyzing the relationship between falls and medication use in older adults residing in an ALF, it was found that antipsychotics and sedative hypnotic treatments were more common in residents who fell rather than those who did not have falls over a 6-month period (Hamza, Adly, Abdelrahman, & Fouad, 2019). In a different study of
Skilled Nursing Facility (SNF) residents, it was found that two different psychotropic medications were consistent in the cumulative incidence of a fall-related injury within 90 days of exposure to the medication (Bronskill et al., 2018). Further research has suggested that pharmacological interventions can be ineffective in controlling symptoms of BPSD, and a Multisensory Stimulation Environment (MSSE) is an example of a nonpharmacological intervention that shows promise (Sánchez et al., 2013).

**Multisensory Stimulation Environments**

In the 1970s, a Snoezelen® room was a coined term to describe a MSSE which was developed and utilized in the Netherlands to stimulate the senses in children with learning disabilities (Bauer et al., 2015). Over the years, research has shown that an MSSE serves as an effective nonpharmacological intervention compared to antipsychotic medication by providing a stress-reducing as well as entertaining environment for older adults diagnosed with dementia with the use of sensory elements to promote relaxation and stimulation (Sánchez, Millán-Calenti, Lorenzo-López, & Maseda, 2013). MSSEs are traditionally used as an alternative therapeutic intervention for BPSD by reducing maladaptive behaviors, promoting positive behaviors, increasing positive mood, promoting a caregiving relationship, and reducing caregiver stress (Milev et al., 2008). MSSE rooms commonly include low lighting and objects catering to the human senses with aroma, sound, water columns, fiber-optic lighting, textured materials, and screen projection (Milev et al., 2008). Milev et al. (2008) report findings from a 24-week study of older adults diagnosed with dementia receiving weekly MSSE treatments showed improved outcomes in behavior observation, as well as positive outcomes for decreased behaviors which were maintained following cessation of the program. Specific modalities often included within
MSSE treatments, such as aroma therapy and bright light therapy, and have also been shown to be successful at managing behavioral problems (Milev et al., 2008). Research of MSSEs as an alternative intervention for reducing neuropsychiatric symptoms and dementia severity suggests that they are more effective than one-to-one activity sessions with care staff (Sánchez et al., 2016). Existing literature describes the use of an MSSE requiring a caregiver to individually escort the subject to the MSSE treatment room, with the caregiver then required to spend time with the subject until the duration of the treatment is met. Due to continued shortages of the nursing workforce in the U.S., it is neither feasible nor reliable to continue to provide an undetermined amount of a sole caregiver’s time to patients experiencing BPSD as this process removes the staff member from the ability to provide care to other patients. Normally, MSSE designs are located in an isolated room with a door to prevent access from other residents or patients of an ALF or SNF while the MSSE is in use.

**Clinical Workforce Demands**

The demand for nurses is projected to grow by more than 200,000 job openings each year from 2016 to 2026, with nursing school programs reporting an insufficient supply of students to meet the projected demands for current and future nursing services (Rosseter, 2019; Torpey, 2018). Likewise, following a study of 600 ALFs, employee turnover rates across all positions were reported at 32% with rates reported at 33% for resident assistants/personal care aides and 27% turnover for licensed nurses in 2018 (Bowers, 2018). Similarly, in a study investigating caregiver burden, Kamiya, Sakurai, Ogama, Maki, and Toba (2014) state that the behavior disturbance and increased mobility of a resident with the diagnosis of dementia may increase burden and stress due to the extra attention and supervision required. Kamiya et al. (2014) further suggest that non-
compliance with medication may cause caregiver mental stress and that the prevention of BPSD is an essential consideration in the management of dementia diagnoses. Literature on employee stress also explains that factors such as high turnover, absenteeism, low job satisfaction, and burnout reduce the quality and effectiveness of patient care in nursing homes (Islam, Baker, Huxley, Russell, & Dennis, 2017). As a result of caregiver burden as described by Kamiya et al. (2014), staffing turnover increases while employee engagement and satisfaction scores are negatively impacted. Additionally, employee engagement within an organization plays a significant role in turnover rates as engaged employees may be more likely to remain committed to their current place of employment and demonstrate to be 1.3 times more likely to be high performers than less engaged employees (Vance, 2006).

**Significance of the Research**

Currently, research is not available investigating whether an MSSE may be effective at reducing BPSD when an older adult is capable of independently utilizing the MSSE without the direct supervision of a care provider. Similarly, literature is not available to show whether an open-floorplan MSSE can be introduced successfully whereby eliminating the enclosure of an isolated room. Presently, there is a gap in literature whether an open-floorplan MSSE can reduce the use of psychotropic medication to treat BPSD, frequency of falls, caregiver turnover, and improve employee satisfaction in an MCAL setting.

**Purpose**

This three-paper dissertation is comprised of studies to address the gaps in literature by investigating the impact of an open-floorplan MSSE design located within an MCAL as it relates
to observed and reported patient and employee outcomes. The first study aims to explore the impact of the MSSE as it relates to BPSD observations. This study analyzed medical chart documentation of 24 MCAL residents’ BPSD episodes observed by care staff over a 12-month period, 6-months prior and 6-months post exposure to an open-floorplan MSSE. The care staff observed fewer episodes of BPSD posttest when compared to total episodes in the pretest.

The second study investigates the use of psychotropic medications and prevalence of falls on the same MCAL unit. This study analyzed 24 residents’ medication administration records to explore psychotropic treatment and the total number of falls that occurred during the 12-month study before and after exposure to an open-floorplan MSSE. Psychotropic medication dose reductions were more prevalent posttest than when compared in the pretest but falls were not found to reduce as a result of the MSSE intervention. The study was impacted by the number of residents living in the MCAL receiving end-of-life services since falls were found to increase as the number of residents on hospice services increased throughout the study.

Finally, the third study examines employee turnover, satisfaction, and engagement for staff providing care to the residents of the MCAL facility when exposed to the MSSE in this pretest/posttest analysis. This study analyzed the survey data and staff turnover trends for 46 employees of the MCAL facility pre and post-installation of the MSSE intervention. Overall, employee turnover rates did decrease following the installation of the MSSE but did not significantly affect employee engagement and satisfaction metrics in the posttest.

References


CHAPTER II

USING AN OPEN-FLOORPLAN MULTISENSORY STIMULATION ENVIRONMENT IN A MEMORY CARE ASSISTED LIVING TO REDUCE BEHAVIORAL AND PSYCHOLOGICAL SYMPTOMS OF DEMENTIA

Background and Significance

The population of older adults is rapidly growing with persons 65 and older in the United States (U.S.) increasing from 43.1 million in 2012 to 83.7 million by 2050 (Ortman, Velkoff, & Hogan, 2014). Additionally, an estimated 4.75 million people with dementia existed in North America in 2015 with this population projected to climb to 7.28 million by 2030 and 11.74 million by 2050 (Alzheimer’s Disease International, 2015). At the same time, the U.S. is projected to experience a shortage of nurses which will only intensify as the aging population (including cases of dementia diagnoses) grows along with a higher demand for a specialized health care workforce (Chenoweth, Jeon, Merlyn, & Brodaty, 2010; Rosseter, 2019).

Persons diagnosed with dementia may be categorized by any of the following conditions: Alzheimer’s disease, vascular dementia, Dementia with Lewy bodies (DLB), mixed dementia, Parkinson’s disease, Frontotemporal lobar degeneration (FTLD), Creutzfeldt-Jakob disease, normal pressure hydrocephalus, Huntington’s disease, and Wernicke-Korsakoff Syndrome (Alzheimer’s Association, 2017). Caring for older adults with these varying forms of dementia requires direct supervision by care providers. These providers may include relatives, hired private-duty caregivers, and personnel who work in long-term care facilities such as Assisted Living Facilities (ALF) and Skilled Nursing Facilities (SNF). Caregivers working in an ALF
may be unlicensed personnel with specific training provided by the facility, a Certified Nursing Assistant (CNA), or a licensed nurse.

Additionally, persons diagnosed with dementia often display behavioral symptoms such as aggressiveness, wandering, depression, agitation, anxiety, repetitive activity, and nighttime disturbances. These are collectively referred to as Behavioral and Psychological Symptoms of Dementia (BPSD) (Alzheimer’s Association, 2017). Observation studies reveal that persons diagnosed with dementia often experience BPSD due to sensory deprivation, particularly those who are institutionalized, and consequently often experience intra-psychic discomfort due to imbalances in sensory-stimulation (Sánchez, Millán-Calenti, Lorenzo-Lopez, & Maseda, 2013). Research further shows that an MSSE serves as an effective nonpharmacological intervention to antipsychotic medication by providing a stress-reducing as well as entertaining environment for this clinical population with the use of sensory elements to promote relaxation and stimulation (Sánchez et al., 2013).

Furthermore, research has suggested that pharmacological interventions can be ineffective in controlling symptoms of BPSD, and an MSSE treatment room is an example of a nonpharmacological intervention that shows promise (Sánchez et al., 2013). MSSEs are traditionally used as an alternative therapeutic intervention for BPSD by reducing maladaptive behaviors, promoting positive behaviors, increasing positive mood, promoting a caregiving relationship, and reducing caregiver stress (Milev et al., 2008). MSSE rooms commonly include low lighting and objects catering to the human senses with aroma, sound, water columns, fiber-optic lighting, textured materials, and screen projection (Milev et al., 2008). Milev et al. (2008) reported findings from a 24-week study of 29 subjects that persons with dementia receiving weekly MSSE treatments showed improved outcomes in observed behavior observation, as well as
positive outcomes for decreased behaviors which were maintained following cessation of the program. Specific modalities often included within MSSE treatments—such as aroma therapy and bright light therapy—have also been shown to be successful at managing behavioral problems (Milev et al., 2008). Research of MSSEs as an alternative intervention for reducing neuropsychiatric symptoms and dementia severity suggests that it is more effective than one-to-one activity sessions with care staff (Sánchez et al., 2016).

Existing literature describes the use of an MSSE requiring a caregiver to individually escort the subject to the MSSE treatment room, with the caregiver then required to spend time with the subject until the duration of the treatment is met. Due to continued shortages of the nursing workforce in the U.S., it is neither feasible nor reliable to continue to provide an undetermined amount of a sole caregiver’s time to patients experiencing BPSD as this process removes the staff member from the ability to provide care to other patients. Normally, MSSE designs are located in an isolated room with a door to prevent access from other residents or patients of an ALF or SNF while the MSSE is in use.

Current studies do not reveal whether an MSSE can be effective at reducing BPSD if an older person may be capable of independently accessing the MSSE and interacting in the environment without the direct supervision of a care provider. Similarly, literature is not available to show whether an MSSE can be introduced successfully into a common-area potentially eliminating the typical enclosure of an isolated room.

**Purpose of the Study**

In this study, an MSSE was designed and located in an existing common-area within a secure MCAL unit intended to be easily accessible by the residents of the unit. This MSSE
intervention provides both calming and stimulating sensory elements for older adults diagnosed with dementia. The purpose of this study was to examine the outcomes of an open-floorplan MSSE among residents of an MCAL center on episodes of BPSD.

**Methods**

This study was conducted by a secondary, aggregated, data analysis of the medical records from a single site. The pre-intervention data were collected on the six months prior to the build and use of an MSSE located in an MCAL facility between the months of September 2017 to February 2018. The post-intervention data consisted of the six-month period following the installation between the months of March 2018 to August 2018. The medical records provided documentation of episodes of BPSD on each shift, each day, for twelve months within an all-inclusive sample of twenty-four residents of an MCAL facility located in a metropolitan area of a Midwest state in the U.S. This research study received ethical approval from the Western Michigan University Human Subjects Institutional Review Board (Appendix A).

**Participants**

The data for this study were obtained from secondary, aggregated, data retrieved from the medical records of an all-inclusive sample of older adults over the age of 65 years with a dementia diagnosis residing in a secured MCAL facility (n = 24). The analysis took place over a 12-month period from September 2017 to August 2018 with installation of the MSSE taking place in March 2018. The MCAL site used for this study can only accommodate a total of twenty residents on its enclosed unit. As participants moved out or passed away during the 12-month study, new residents moved into the vacant rooms.
Measure

The study population resided in a 20-unit MCAL facility, having met the facility’s criteria for admission. In order to meet criteria for admission, staff at the MCAL facility conducted a Mini-Mental State Examination (MMSE) on each older adult prior to their admission. A score on the MMSE (Folstein, Folstein, & McHugh, 1975) of 19 or less was required before approval for admission to the MCAL was granted by a physician. Next, the facility’s Level of Care Assessment Tool (LOCAT; unpublished) was completed to determine level of care needs upon admission. The LOCAT was utilized to determine fourteen different level of care needs based on a 0 to 130-point scale and the older adult needed to have a rating between 29 to 65 points to be approved for residing in the MCAL.

Procedure

The study subjects were observed by the care providers of the MCAL on each shift as the residents voluntarily interacted in their living environment. The MCAL setting was a secured unit including twenty apartments designated only for residents diagnosed with dementia. Due to the open-floorplan design of the MSSE, the subjects could interact with the space independently or prompted by care staff when deemed appropriate (see Figure 2-1). Subjects were permitted to voluntarily enter or exit the MSSE at any time, day or night. The care providers of each shift would then document any BPSD episodes for the sample group in the medical record.

Environment design. The MSSE was created as an open-floorplan design located in a common-area of the MCAL secured unit which housed twenty apartments for older adults diagnosed with dementia and meeting criteria identified by the MCAL care providers. This MSSE
Figure 2-1. Floorplan of the Memory Care Assisted Living facility.

was designed to permit residents of the MCAL to voluntarily enter and exit the MSSE at any time without the closure of a door or walls to enclose the treatment space. This design was created with the goal to reduce the need for care providers to escort a resident to utilize the space with the additional benefit of the location of the MSSE, allowing care providers to have the ability to view the resident’s use of the space from a distance to monitor the safety of the resident. Staff of the unit are commonly dispersed about the unit providing care, holding activities and events, as well as serving meals in the dining room throughout the day. The nurse’s station is located in a room adjacent to the MSSE space which allows staff to be in proximity without the need to personally escort residents to utilize the MSSE space. The MSSE space was built to include only one or two sensory elements per sensory category to reduce potential for over-stimulation in the space.
The MSSE integrated five sensory categories including aroma therapy with a lavender scent diffuser. No other scents were used during the course of this study in order to maintain control of the aroma stimulant for the MSSE. The MSSE was designed to be fully automated by utilizing aroma therapy equipment that activated automatically.

The visual stimulation element included LED up-lighting that projected up the walls of the space as well as low-lighting installed in the ceiling of the MSSE. This lighting was programmed to change at certain times of day reducing the need for care providers to interact with the equipment. Settings for the lighting were pre-set to “Relax-mode”, “Uplift”, “Evening”, and “Daytime” which corresponded to color related to the intended mood.

Audible elements were provided by an internal sound system which could play soothing and stimulating sound sequences at the discretion of the care provider activating the sound system. The sound system for this room was recessed into the ceiling of the room.

The tactile elements of the MSSE included varying textures of furniture and fabric carefully selected for the room. These tactile pieces included wooden furniture, tiled surfaces on coffee and side tables, wicker chairs, canvas and polyester textured pillows, as well as a brick wall, PVC railing which mimicked a picket fence, and glass windows.

Finally, the vestibular element was achieved with the placement of rocking chairs and glider chairs in the room. These chairs were accessible by the subjects without the need for assistance from a care provider to transfer to the seat for use.

**Documentation.** The care providers of the MCAL documented whether a resident exhibited signs of BPSD on the day and night shifts of each day. The documentation allowed for free text where the care provider could document whether a resident had a good day with no
BPSD episodes or whether BPSD episodes did occur during the documented timeframes. The care provider completing the documentation did not account for whether the subject entered the MSSE on each shift.

**Variables.** The open-floorplan MSSE design located on the MCAL secured unit served as the independent variable for this study. The documented BPSD episodes found in the subject’s medical record by the MCAL care providers was the dependent variable in this pretest-posttest analysis. The amount of time a subject spent utilizing the MSSE was not considered in this study.

**Results**

The aggregated data retrieved from medical chart documentation listed observed BPSD episodes of each subject for each shift equaling 5,159 total observations documented by MCAL staff during the analysis period between September 1, 2017 to August 31, 2018. The documented observations either noted that a BPSD episode was observed or “no behaviors observed” was noted by the caregiver for each shift of work in the medical record. Following the MSSE installation in the MCAL center, the number of observed BPSD episodes decreased from 367 documented observations prior to the installation to 298 documented observed episodes after the installation (see Table 2-1). A total of 2,163 documented observations, either observing a BPSD episode or none observed, were documented prior to the installation of the MSSE with 16.9% of total episodes documented as a BPSD episode. A total of 2,996 observations were documented after installation of the MSSE with 9.9% of total episodes documented reported as a BPSD episode. A Comparison of Proportions test determined that the difference in the proportion of BPSD episodes documented pre- and post-intervention was statistically significant, $X^2(1) = 55.136$, $p < 0.0001$. 
Table 2-1

*Documented BPSD Observed Episodes before and after MSSE Installation*

<table>
<thead>
<tr>
<th>BPSD Episode</th>
<th>MSSE, Pre-test</th>
<th>MSSE, Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>367</td>
<td>298*</td>
</tr>
<tr>
<td>None Observed</td>
<td>1,796</td>
<td>2,698</td>
</tr>
<tr>
<td>Total Observations</td>
<td>2,163</td>
<td>2,996</td>
</tr>
</tbody>
</table>

*Note: BPSD = Behavioral and Psychological Symptoms of Dementia, MSSE = Multisensory Stimulation Environment
*Statistically Significant $p < 0.000$

**Demographics**

Participants’ ages ranged from 77 to 97 years ($M = 87.8, SD = 4.9$) with 25% identified as men ($n = 6$) and 75% identified as women ($n = 18$). The subjects ranged from .10 to 6.10 years residing in the MCAL ($M = 1.8$). The sample group consisted of 95.8% White, non-Hispanic ($n = 23$) and 4.2% White, Hispanic ($n = 1$) participants. The participant group consisted of 34.6% with an Alzheimer’s disease diagnosis ($n = 9$), 34.6% with an unspecified dementia diagnosis ($n = 9$), 15.4% with Vascular dementia ($n = 4$), 7.7% with Parkinson’s disease (PD) dementia ($n = 2$), 3.8% with Dementia with Lewy bodies (DLB) ($n = 1$), and 3.8% with Frontotemporal lobar degeneration (FTLD) ($n = 1$). Only 29.2% of the population were able to ambulate on the unit without an assistive device ($n = 7$) while 54.2% required a walker ($n = 13$), 12.5% needed a wheelchair ($n = 3$), and 4.2% utilized a wheelchair and a walker as needed ($n = 1$) (see Table 2-2).
Table 2-2

Descriptive Statistics of the Participants

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in Years</td>
<td>87.8</td>
<td>4.9</td>
<td>77</td>
<td>97</td>
</tr>
<tr>
<td>Years residing at MCAL</td>
<td>1.8</td>
<td>1.8</td>
<td>0.1</td>
<td>6.10</td>
</tr>
</tbody>
</table>

<table>
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<tr>
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Note. M = Mean, SD = Standard deviation, Min. = Minimum value, Max. = Maximum value

Discussion

This study aimed to address the current gaps in literature of an MSSE located on an MCAL unit intended for independent use by ambulatory older adults diagnosed with dementia. We hypothesized that the installation of an open-floorplan MSSE design could reduce the
episodes of BPSD in older adults diagnosed with dementia. Typically, MSSEs are not designed so that an older adult with dementia is able to enter and exit the room voluntarily. MSSEs in MCAL settings are commonly located in a room with a door and do not encourage use without the direct supervision of a caregiver. The results of this study suggest that an MSSE can be designed in a location within an MCAL that can be entered and exited freely by older adults with dementia, without requiring a caregiver to escort them to use or directly supervise within the space while still improving outcomes of BPSD.

In comparison to the present study, a systematic literature review was conducted to explore the impact of MSSEs on BPSD and the findings of 12 studies published between the years of 1990 and 2015 (Lorusso & Bosch, 2018). Comparable to the present study, the 12 studies reviewed by Lorusso and Bosch (2018) included furniture, fixtures, and equipment to provide visual, auditory, tactile, and olfactory stimulation as elements of the MSSE design. Similar to the present study, these studies reported a predominantly female subject population and 6 of the studies also utilized the Mini-Mental State Examination (MMSE) to quantify the participant’s level of dementia (Lorusso & Bosch, 2018). Furthermore, the 12 studies reported positive results regarding the impact of the MSSE treatment on BPSD, noting an overall decrease in the number of BPSD incidences with this form of behavioral intervention (Lorusso & Bosch, 2018). Conversely, several of the studies investigated biomedical parameters such as heart rate showing a decrease in mean heart rate as a result of the treatment session, suggesting lesser physiological load in such environments (Lorusso & Bosch, 2018). The present study did not monitor biomedical response.

In another literature review, the findings of 18 studies conducted between the years of 1990 and 2012 utilizing an MSSE as an intervention for BPSD in older adults were investigated
(Sánchez et al., 2013). In contrast to the present study, Sánchez et al. (2013) found that most of the 18 studies in review followed a one-to-one style treatment and took place in a specifically designed MSSE room. Furthermore, these studies provided various intervention methods such as daily MSSE sessions for a period of 15 months to older adults averaging about 30 minutes per treatment session (Sánchez et al., 2013). In comparison to the present study, the MSSE interventions reported positive effects on BPSD; however, long-term benefits and the generalization of the results to other environments are still unknown (Sánchez et al., 2013).

The limitations of the present study include the inability to generalize the open-floorplan design in other MCAL settings as any alterations in floorplan, subject population, and caregiver population may alter results. The present study did not control for the amount of time subjects utilized the MSSE as an intervention. Moreover, the present study did not monitor the number of times a subject may have entered or exited the MSSE space on each shift. Some possible confounders of the present study requiring future research include potential conflicting stimuli occurring outside of the designated MSSE space which could impact outcomes by increasing or decreasing BPSD. Conflicting stimuli may be defined as sound and movement activity taking place adjacent to the MSSE space which could be distracting to the subject utilizing the MSSE. Additionally, biomedical factors were not controlled for the purposes of this study. Biomedical factors that could impact BPSD episodes are medication changes, physical pain, illnesses, and hallucinations. Other factors potentially affecting validity in this study may be that the care staff documentation could have differed between staff members due to understanding of behaviors associated with older adults diagnosed with dementia. Moreover, the study population in this analysis was mostly homogenous with 23 White, non-Hispanic, and 1 White, Hispanic, residents living in the MCAL. While the installation of the MSSE in the present study showed evidence of
improvement in BPSD episodes, other factors such as race, ethnicity, and sex may play a role in usage and response to the MSSE. In addition, socioeconomic status may play a role in access to MCAL settings and there may be differences in usage and response to the MSSE. In a study exploring the caregivers’ perspectives of BPSD episodes experienced by older adults diagnosed with dementia, findings report that African-American caregivers report less upset and more confidence in managing aggressive behaviors when compared to white caregivers (Hansen, Hodgson, & Gitlin, 2018). Different cultures’ varying perceptions, as a care provider of residents with dementia, could play a role in the number of reported, or underreported, BPSD episodes which would alter the total documented episodes, as conducted in the present study. A different study examining the effects of education and race on cognitive decline in older adults suggests that while Non-Hispanic White participants had higher baseline educational scores than African-American and Hispanic participants, race/ethnicity and education do not have a strong effect or act as a major determinant of cognitive decline (Gross et al., 2015). Gross et al. (2015) state that it is likely that diseases of aging such as Alzheimer’s disease and other progressive dementing illnesses act as strong determinants of cognitive decline in older adults. The present study did not include a multicultural sample or variation in socioeconomic status for analysis to explore the variations in cognition and BPSD episodes that would coincide with dementia-related diagnosis.

This study did, however, show that an MSSE open-floorplan design can be built in an applied setting successfully and may provide improved outcomes to episodes of BPSD. Additionally, the open-floorplan design was successful in its approach due to the subject population having the ability to independently ambulate within the MCAL unit as well as enter and exit the MSSE voluntarily.
In summary, this research addressed gaps in literature by studying the independent use and outcomes of an open-floorplan MSSE design located in an MCAL facility. This work builds upon existing research by revealing that an MSSE may positively improve mood and behavior in older adults but with the added component that the older adult may utilize the MSSE without the need of a care provider to provide direct supervision while the space is in use. However, more work on this topic is needed.

**Conclusion**

This study represented an analysis of an open-floorplan MSSE to reveal effectiveness in its use as a nonpharmacological intervention reducing the need of a care provider to directly supervise an older adult diagnosed with dementia for the duration of a treatment session. Furthermore, this study reveals that an ambulatory older adult diagnosed with dementia can utilize an MSSE independently with positive outcomes in BPSD episodes.

We recommend additional studies of the MSSE with an open-floorplan design for persons diagnosed with dementia in order to add to the evidence-based research needed to continue to support greater adoption of the MSSE’s in MCAL settings. Additionally, the length of time studying the MSSE in MCAL settings should be extended in an effort to reveal longer term impact of the intervention. Furthermore, studying the open-floorplan MSSE in locations of varying socio-economic status, levels of cognitive decline, and caregiver demographics are recommended to determine how race and ethnicity is affected by an open-floorplan MSSE to add to the evidence-based research to expand the generalizability of the intervention. Finally, additional interdisciplinary contributions to the planning and design process—such as adding further clinical, architectural, and therapeutic insights—may improve the MSSE intervention for persons diagnosed with dementia.
The use of nonpharmacological intervention for older adults diagnosed with dementia and suffering from BPSD is significantly relevant in current clinical practices. The population of older adults is increasing dramatically along with the increase in diagnoses of dementia. Moreover, the clinical workforce is continuing to decline with patient-to-caregiver ratios shifting. The use of MSSEs is growing in popularity in nursing homes and has been shown to be a successful alternative to psychotropic medications to reduce BPSD. This study reveals that an MSSE may still have a positive impact on BPSD episodes in an open-floorplan setting without the need for a care provider to dedicate direct supervision to an ambulatory older adult diagnosed with dementia.

References


CHAPTER III

THE IMPACT OF AN OPEN-FLOORPLAN MULTISENSORY STIMULATION ENVIRONMENT DESIGN ON THE USE OF PSYCHOTROPIC MEDICATIONS AND PREVALENCE OF FALLS IN A MEMORY CARE ASSISTED LIVING FACILITY

Background and Significance

The population of older adults is rapidly growing with persons 65 and older in the United States (U.S.) increasing from 43.1 million in 2012 to 83.7 million by 2050 (Ortman, Velkoff, & Hogan, 2014). Additionally, an estimated 4.75 million people with dementia existed in North America in 2015 with this population projected to climb to 7.28 million by 2030 and 11.74 million by 2050 (Alzheimer’s Disease International, 2015). At the same time, the U.S. is projected to experience a shortage of nurses which will only intensify as the aging population, including cases of dementia diagnoses, grows along with a higher demand for a specialized health care workforce (Chenoweth, Jeon, Merlyn, & Brodaty, 2010; Rosseter, 2019).

Individuals diagnosed with dementia may be categorized by any of the following conditions: Alzheimer’s disease, vascular dementia, Dementia with Lewy bodies (DLB), mixed dementia, Parkinson’s disease, Frontotemporal lobar degeneration (FTLD), Creutzfeldt-Jakob disease, normal pressure hydrocephalus, Huntington’s disease, and Wernicke-Korsakoff Syndrome (Alzheimer’s Association, 2017). Caring for older adults with these varying forms of dementia requires direct supervision by care providers. These providers may include relatives, hired private-duty caregivers, and personnel who work in long-term care facilities such as ALFs and Skilled Nursing Facilities (SNF). Caregivers working in an ALF may be unlicensed
personnel with specific training provided by the facility, a Certified Nursing Assistant (CNA), or a licensed nurse.

Additionally, persons diagnosed with dementia often display behavioral symptoms such as aggressiveness, wandering, depression, agitation, anxiety, repetitive activity, and nighttime disturbances. These are collectively referred to as Behavioral and Psychological Symptoms of Dementia (BPSD) (Alzheimer’s Association, 2017). Observation studies reveal that persons diagnosed with dementia often experience BPSD due to sensory deprivation, particularly those who are institutionalized, and consequently often experience intra-psychic discomfort due to imbalances in sensory-stimulation (Sánchez, Millán-Calenti, Lorenzo-Lopez, & Maseda, 2013).

In the 1970s, a Snoezelen® room was a coined term to describe a Multisensory Simulation Environment (MSSE) which was developed and utilized in the Netherlands to stimulate the senses in children with learning disabilities (Bauer et al., 2015). Over the years, research has shown that an MSSE serves as an effective nonpharmacological intervention compared to antipsychotic medication by providing a stress-reducing as well as entertaining environment for older adults diagnosed with dementia with the use of sensory elements to promote relaxation and stimulation (Sánchez et al., 2013). Moreover, pharmacological interventions, such as antipsychotics, show to be ineffective in controlling symptoms of BPSD, and an MSSE treatment room is an example of a nonpharmacological intervention that shows promise (Sánchez et al., 2013). MSSEs are traditionally used as an alternative therapeutic intervention for BPSD by reducing maladaptive behaviors, promoting positive behaviors, increasing positive mood, promoting a caregiving relationship, and reducing caregiver stress (Milev et al., 2008). While there is no formal standard in the design of an MSSE, these treatment rooms commonly include low lighting with objects catering to the human senses such as aroma, sound, water columns, fiber-optic lighting, textured
materials, and screen projection (Milev et al., 2008). Milev et al. (2008) reported findings from a 24-week pilot study of 29 subjects that persons with dementia receiving weekly MSSE treatments presented improved outcomes in observed behavior observation, as well as positive outcomes for decreased behaviors which were maintained following cessation of the program. Specific modalities often included within MSSE treatments—such as aroma therapy and bright light therapy—have also been shown to be successful at managing behavioral problems (Milev et al., 2008). Research of MSSEs as an alternative intervention for reducing neuropsychiatric symptoms and dementia severity suggests that it is more effective than one-to-one activity sessions with care staff (Sánchez et al., 2016). In a literature review of 12 different studies utilizing an enclosed MSSE requiring one-to-one supervision, Lorusso and Bosch (2018) state that evidence support that an MSSE shows positive impact on the nonpharmacological treatment for BPSD.

Existing literature describes the use of an MSSE requiring a caregiver to individually escort the patient to the MSSE treatment room, with the caregiver then required to spend time with the subject until the duration of the treatment is met. Due to continued shortages of the nursing workforce in the U.S., it is neither feasible nor reliable to continue to provide an undetermined amount of a sole caregiver’s time to patients experiencing BPSD as this process removes the staff member from the ability to provide care to other patients. Normally, MSSE designs are located in an isolated room with a door to prevent access from other residents or patients of an ALF or SNF while the MSSE is in use.

Commonly, older adults experiencing BPSD are treated with psychotropic medications such as anxiolytics, antidepressants, and antipsychotics (Lindsey, 2009). The American Geriatrics Society Beers Criteria® (AGS Beers Criteria®) for Potentially Inappropriate Medications (PIM) recommend that clinicians avoid the use of antipsychotics as a treatment for psychosis, including
BPSD, due to study findings to be ineffective and increase safety concerns in older adults (Fick et al., 2019). Older adults are found to have increased sensitivity to benzodiazepines as these antipsychotics increase the risk of cognitive impairment, delirium, falls, and fractures (Fick et al., 2019). Moreover, the AGS Beers Criteria® recommends that antiepileptics, antipsychotics, and antidepressants be avoided due to the increased risk of falls and fractures in older adults with the combination of three or more of these medications further increasing fall risks (Fick et al., 2019). Similarly, the pro re nata (PRN), “as needed”, administration of benzodiazepines and neuroleptics for the treatment of BPSD contribute to further fall risks (Neumann, Faris, & Klassen, 2015). In a study showing the association between psychotropic medications and BPSD, Ozaki, Katsumata, and Arai (2019) found that psychotropic medications significantly increased the number and severity of BPSD symptoms and newly prescribed psychotropic medications were associated with increased caregiver burden compared to non-psychotropic medication users. Finally, Hamza, Adly, Abdelrahman, and Fouad (2019) report the higher risk and prevalence of resident falls in an ALF for those prescribed psychotropic medications for the treatment of BPSD.

As an older adult reaches end-of-life stages requiring additional assistance with pain management and support through their functional decline, hospice services are voluntarily available for residents within ALFs. Common indicators that can be found as a person reaches end-of-life would be functional and nutritional decline, emotional distress, delirium, and the increased prevalence of falls (Amblàs-Novellas et al., 2016; Smucker, Regan, Elder, & Gerrety, 2014).

Current studies do not reveal whether an MSSE can be effective at reducing psychotropic medication use and the prevalence of falls when installed in a Memory Care Assisted Living (MCAL) facility. Moreover, peer reviewed literature is not available to show whether an open-
floorplan MSSE design, built within an MCAL, can be effective at reducing the use of PRN psychotropic medication to treat BPSD.

**Purpose of the Study**

In this study, an MSSE was designed and located in an existing common-area within a secure MCAL unit intended to be independently accessible by the residents of the unit. This MSSE intervention provides both calming and stimulating sensory elements for older adults diagnosed with dementia. The purpose of this study was to examine the administration of psychotropic medication, PRN medication use, and the prevalence of falls with the use of an open-floorplan MSSE as a nonpharmacological intervention for older adults diagnosed with dementia residing in an MCAL facility.

**Methods**

This study was conducted by a secondary, aggregated, data analysis of the medical records from a single site. The pre-intervention data were collected on the six months prior to the build and use of an MSSE located in an MCAL facility between the months of September 2017 to February 2018. The post-intervention data consisted of the six-month period following the installation between the months of March 2018 to August 2018.

**Participants**

The data for this study were obtained from secondary, aggregated, data retrieved from the medical records of an all-inclusive sample of older adults over the age of 65 years with a dementia diagnosis residing in a secured MCAL facility ($n = 24$). The analysis took place over a 12-month
period from September 2017 to August 2018 with installation of the MSSE taking place in March 2018. The MCAL site used for this study can only accommodate a total of twenty residents on its enclosed unit. A total of four participants moved out or passed away during the 12-month study representing a 20% attrition rate for the duration of the study.

**Demographics**

The total study population ages ranged from 77 to 97 years \((M = 87.8, SD = 4.9)\) with 21% identified as men \((n = 5)\) and 79% identified as women \((n = 19)\). The study population remained constant with a total of 20 participants pretest and posttest; however, there was an increase in females from pretest \((n = 16)\) to posttest \((n = 17)\) with a decrease in males in the pretest \((n = 4)\) compared to posttest \((n = 3)\).

The subjects ranged from 0.1 to 6.1 years residing in the MCAL \((M = 1.8)\). This study group’s average residency changed from pretest to posttest with average years decreasing from 2.2 to 1.8.

The study population consisted of 96% White, non-Hispanic \((n = 23)\) and 4% White, Hispanic \((n = 1)\) participants. The population remained constant in pretest and posttest with 95% White, non-Hispanic \((n = 19)\) subjects and 5% White, Hispanic participants \((n = 1)\) in the study.

The participant group consisted of 38% of older adults diagnosed with an Alzheimer’s disease diagnosis \((n = 9)\), 38% with an unspecified dementia diagnosis \((n = 9)\), 17% with Vascular dementia \((n = 4)\), 8% with Parkinson’s disease (PD) dementia \((n = 2)\), 4% with Dementia with Lewy bodies (DLB) \((n = 1)\), and 4% with Frontotemporal lobar degeneration (FTLD) \((n = 1)\). The population remained constant in pretest and posttest for older adults diagnosed with DLB \((n = 1)\), FTLD \((n = 1)\), PD \((n = 2)\), and Vascular dementia \((n = 15)\). The population with an
Alzheimer’s diagnoses changed from 35% \((n = 7)\) in pretest to 45% \((n = 9)\) in posttest. The Unspecified dementia group decreased from 35% \((n = 7)\) in pretest to 30% \((n = 6)\) in posttest.

Additionally, 30% of the population were able to ambulate on the unit without an assistive device \((n = 7)\) while 54% required a walker \((n = 13)\), and 17% needed a wheelchair \((n = 4)\). The group ambulating without an assistive device decreased from 35% \((n = 7)\) in pretest to 30% \((n = 6)\) in posttest. The population remained constant in pretest and posttest for the number of participants requiring a walker \((n = 11)\). The group requiring a wheelchair to ambulate increased from 15% \((n = 3)\) in pretest to 20% \((n = 4)\) in posttest.

Finally, 13% of the population were receiving hospice services \((n = 3)\). The population of older adults receiving hospice care increased from 10% \((n = 2)\) in pretest to 15% \((n = 3)\) in posttest (see Table 3-1).

**Measure**

The study population resided in a 20-unit MCAL facility, having met the facility’s criteria for admission. In order to meet criteria for admission, staff at the MCAL facility conducted a Mini-Mental State Examination (MMSE) on each older adult prior to their admission. A score on the MMSE \((\text{Folstein, Folstein, \& McHugh, 1975})\) of 19 or less was required before approval for admission to the MCAL was granted by a physician. Next, the facility’s Level of Care Assessment Tool (LOCAT; unpublished) was completed to determine level of care needs upon admission. The LOCAT was utilized to determine fourteen different level of care needs based on a 0 to 130-point scale and the older adult needed to have a rating between 29 to 65 points to be approved for residing in the MCAL.
Table 3-1

Descriptive Statistics of the Participants

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<td>7 (30)</td>
<td>7 (35)</td>
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Subjects were determined to require psychotropic medication for treatment as prescribed by their attending physician at the MCAL. The data of this study included only administered
psychotropic medication including PRN medication given. Medications prescribed, but not administered, were not included in the data analysis. Dosages of medications analyzed were collected for this study as recorded in the medical record.

The care staff of the MCAL documented falls experienced by the subjects each day. Falls documented in the medical record included observed falls as well as resident-reported falls.

**Procedure**

The study subjects were attended by clinical staff and retained medical records that were complete with medication administration records (MAR) describing the type of medication ordered, diagnoses for treatment, and the date and time when the medication was administered to the resident. Only the psychotropic medications administered in the MAR were used for the data analysis of this study. Administered psychotropic medications categorized as antidepressants, antipsychotics, mood stabilizers, and anxiolytics were gathered for the analysis.

The study subjects were observed by the care staff of the MCAL and staff documented in the medical record when a resident experienced a fall each day. This documentation allowed for free text to further explain whether a resident suffered an injury as a result of the fall. The available documentation was not existing to explain why the fall occurred for each resident. This procedure of documenting falls was originally part of existing care routines and was not specifically designed for the purposes of this study.

**Environment design.** The MSSE was created as an open-floorplan design located in a common-area of the MCAL secured unit which housed twenty apartments for older adults diagnosed with dementia and meeting criteria identified by the MCAL care providers. This MSSE was designed to permit residents of the MCAL to voluntarily enter and exit the MSSE at any
time without the closure of a door or walls to enclose the treatment space. This design was created with the goal to reduce the need for care providers to escort a resident to utilize the space with the additional benefit of the location of the MSSE, allowing care providers to have the ability to view the resident’s use of the space from a distance to monitor the safety of the resident. The MSSE space was built to include only one or two sensory elements per sensory category to reduce potential for over-stimulation in the space.

The MSSE integrated five sensory categories including aroma therapy with a lavender scent diffuser. No other scents were used during the course of this study in order to maintain control of the aroma stimulant for the MSSE. The MSSE was designed to be fully automated by utilizing aroma therapy equipment that activated automatically.

The visual stimulation element included LED up-lighting that projected up the walls of the space as well as low-lighting installed in the ceiling of the MSSE. This lighting was programmed to change at certain times of day, reducing the need for care providers to interact with the equipment. Settings for the lighting were pre-set to “Relax-mode”, “Uplift”, “Evening”, and “Daytime” which corresponded to color related to the intended mood.

Audible elements were provided by an internal sound system which could play soothing and stimulating sound sequences at the discretion of the care provider activating the sound system. The sound system for this room was recessed into the ceiling of the room.

The tactile elements of the MSSE included varying textures of furniture and fabric carefully selected for the room. These tactile pieces included wooden furniture, tiled surfaces on coffee and side tables, wicker chairs, canvas and polyester textured pillows, as well as a brick wall, PVC railing which mimicked a picket fence, and glass windows.
Finally, the vestibular element was achieved with the placement of rocking chairs and glider chairs in the room. These chairs were accessible by the subjects without the need for assistance from a care provider to transfer to the seat for use.

**Variables and analysis.** The open-floorplan MSSE design located on the MCAL secured unit served as the independent variable for this study. The psychotropic medications administered to subjects documented in the medical record by the MCAL licensed staff and the number of subject falls documented were the dependent variables in this pretest-posttest analysis. The resident psychotropic medication and fall characteristics in this study were compared using a Comparison of Proportions test; a p value of <0.05 was considered significant.

**Results**

Data were available for the 24 residents residing in the MCAL during the study period between September 1, 2017 to August 31, 2018 with only 20 residents living within the MCAL pretest and 20 residents in the posttest. A series of tests were run to analyze significance in the pretest/posttest as it related to psychotropic medication administration and the prevalence of falls during the study. This population included 3 residents receiving hospice care for end-of-life treatment. The prevalence of falls for these residents was analyzed both within the total sample group and separately analyzed from the group not receiving hospice services.

**Psychotropic Medications**

The data retrieved from the medical chart revealed a total of 353 psychotropic routine medications and 44 PRN medications were administered between the months of September 2017
to August 2018. The number of residents receiving psychotropic medications prior to the MSSE installation was 19 and decreased to 18 in the posttest.

**Psychotropic medications, total.** A total of 175 routine psychotropic medications were administered prior to the installation of the MSSE showing to be 49.6% of total psychotropic medications were given pretest. A total of 178 routine psychotropic medications were administered after the installation of the MSSE showing to be 50.4% of total psychotropic medications were given posttest (see Table 3-2). A Comparison of Proportions test determined that the difference in the proportion of total psychotropic medications administered pre- and post-intervention was not statistically significant, $X^2(1) = 0.051, p = 0.8214$.

**Psychotropic medications, PRN.** A total of 21 PRN psychotropic medications were administered prior to the MSSE installation showing to be 5.9% of psychotropic medications administered. A total of 23 PRN psychotropic medications were administered revealing to be 6.5% of medications given following the installation (see Table 3-2). A Comparison of Proportions test determined that the difference in the proportion of PRN psychotropic medications administered pre- and post-intervention was not statistically significant, $X^2(1) = 0.098, p = 0.7543$.

**Psychotropic medications, dose reductions.** There were 0 psychotropic medication dose reductions ordered by the physician prior to the installation of the MSSE showing to be 0% of total psychotropic medications dose management alterations ordered by the physician pretest. A total of 5 psychotropic medication dose reductions were ordered after the installation of the MSSE revealing to be 1.4% of total psychotropic medication dose management alterations ordered by the physician posttest (see Table 3-3). A Comparison of Proportions test determined that the
Table 3-2

*Psychotropic Medications and PRN Administered Pretest/Posttest*

<table>
<thead>
<tr>
<th>Psychotropic Medication Type</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Routine Prescription</td>
<td>PRN</td>
</tr>
<tr>
<td></td>
<td>( n = 175 )</td>
<td>( n = 21 )</td>
</tr>
</tbody>
</table>

**Antidepressants**
- Cymbalta (duloxetine): 6 -- 6 --
- Lexapro (escitalopram): 21 -- 16 --
- Zoloft (sertraline): 33 -- 31 --
- Wellbutrin (bupropion): 6 -- 6 --
- Desyrel (trazodone): 7 1 11 --
- Celexa (citalopram): 0 -- 5 --

**Antipsychotics**
- Risperdal (risperidone): 6 -- 6 --
- Seroquel (quetiapine): 6 -- 6 --
- Zyprexa (olanzapine): 1 -- 0 --

**Mood stabilizers**
- Depakote (divalproex sodium): 6 -- 7 --

**Anxiolytics**
- Ativan (lorazepam)*: 20 14 29 20
- Xanax (alprazolam)*: 6 6 3 3

**Other**
- Exelon (rivastigmine): 18 -- 13 --
- Aricept/ Donepezil: 39 -- 39 --

*Note: PRN = as needed medication, all medications calculated were administered as documented in the MAR, *denotes the medication as a benzodiazepine.*

difference in the proportion of dose reductions for psychotropic medications prescribed pre- and post-intervention was statistically significant, \( X^2(1) = 4.970, p = 0.0258. \)

**Total residents.** There was a total of 19 residents treated with at least one type of psychotropic medication comprising of 79.2% of total subjects prior to the installation of the MSSE. The number of residents treated with a psychotropic medication decreased to 18
revealing that 75.0% of residents were treated in posttest (see Table 3-3). A Comparison of Proportions test determined that the difference in the proportion of residents treated with a psychotropic medication pre- and post-intervention was not statistically significant, $X^2(1) = 0.117, p = 0.7319$.

Table 3-3

*Total Documented Psychotropic Medications Routine, PRN, and Dose Reductions*

<table>
<thead>
<tr>
<th></th>
<th>MSSE Pretest</th>
<th></th>
<th></th>
<th>MSSE Posttest</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Routine</td>
<td>PRN</td>
<td>Dose</td>
<td>Routine</td>
<td>PRN</td>
<td>Dose</td>
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<tr>
<td></td>
<td>Prescription</td>
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<td>Prescription</td>
<td>(n = 21)</td>
<td>Reductions</td>
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<tr>
<td></td>
<td>(n = 175)</td>
<td>(n = 178)</td>
<td>(n = 0)</td>
<td>(n = 23)</td>
<td>(n = 5)</td>
<td>(n = 0)</td>
</tr>
<tr>
<td></td>
<td>Residents</td>
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<td>residents</td>
<td>Residents</td>
<td></td>
<td>residents</td>
</tr>
<tr>
<td></td>
<td>Treated</td>
<td></td>
<td>Treated</td>
<td>Treated</td>
<td></td>
<td>Treated</td>
</tr>
<tr>
<td></td>
<td>(n = 19)</td>
<td></td>
<td>(n = 18)</td>
<td>(n = 19)</td>
<td></td>
<td>(n = 18)</td>
</tr>
</tbody>
</table>

|                  | Antidepressants | 73 | 1 | -- | 12 | Antidepressants | 75 | -- | 2 | 11 |
|                  | Antipsychotics | 13 | -- | -- | 3 | Antipsychotics | 12 | -- | 2 | 2 |
|                  | Mood Stabilizers | 6 | -- | -- | 1 | Mood Stabilizers | 7 | -- | -- | 2 |
|                  | Anxiolytics | 26 | 20 | -- | 5 | Anxiolytics | 32 | 23 | 1 | 6 |
|                  | Other | 57 | -- | -- | 12 | Other | 52 | -- | -- | 10 |

*Note:* MSSE = Multisensory Stimulation Environment PRN = as needed medication, all medications calculated were administered as documented in the MAR, Dose Reductions = reduction in medication dosage in the timeframe analyzed.

**Prevalence of Falls**

The data retrieved from the medical chart revealed a total of 97 MCAL resident falls were documented to have occurred from September 2017 to August 2018. A total of 13 residents
fell in the pretest, with 2 residents receiving hospice services, and 16 residents fell in the posttest, with 3 receiving hospice services.

**Total falls.** A total of 41 resident falls were documented to have occurred prior to the installation of the MSSE showing to be 42.3% of total falls documented. A total of 56 resident falls were documented after the installation of the MSSE revealing that 57.8% of resident falls took place posttest (see Table 3-4). A Comparison of Proportions test determined that the difference in the proportion of resident falls documented pre- and post-intervention was statistically significant, $X^2(1) = 4.637, p = 0.0313$.

**Total falls, non-hospice.** Additionally, there were 33 documented resident falls, excluding patients on hospice care, prior to the installation of the MSSE showing that 34.0% of resident falls, non-hospice, took place. A total of 38 falls were documented for residents, excluding those on hospice care, following the installation of the MSSE showing that 39.2% of resident falls, non-hospice, took place (see Table 3-4). A Comparison of Proportions test determined that the difference in the proportion of resident falls, non-hospice, documented pre- and post-intervention was not statistically significant, $X^2(1) = 0.562, p = 0.4534$.

**Total falls, hospice.** A total of 8 falls for hospice residents were documented to have fallen prior to the installation of the MSSE showing to be 8.3% of falls documented. A total of 18 hospice-resident falls were documented after the installation of the MSSE revealing that 18.6% of resident falls took place posttest (see Table 3-4). A Comparison of Proportions test determined that the difference in the proportion of falls documented for residents on hospice pre- and post-intervention was statistically significant, $X^2(1) = 4.397, p = 0.0360$. 
Table 3-4

*Total Falls and Proportions for MCAL Residents, Non-hospice, and Hospice*

<table>
<thead>
<tr>
<th></th>
<th>MSSE, Pre-test n (%)</th>
<th>MSSE, Post-test n (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Falls</td>
<td>41 (42.3)</td>
<td>56 (57.8)</td>
<td>0.0313*</td>
</tr>
<tr>
<td>Falls, non-hospice</td>
<td>33 (34.0)</td>
<td>38 (39.2)</td>
<td>0.4534</td>
</tr>
<tr>
<td>Falls, hospice</td>
<td>8 (8.3)</td>
<td>18 (18.6)</td>
<td>0.0360*</td>
</tr>
<tr>
<td>Total MCAL Residents</td>
<td>13 (54.2)</td>
<td>16 (66.7)</td>
<td>0.3809</td>
</tr>
<tr>
<td>Total Residents, non-hospice</td>
<td>11 (45.8)</td>
<td>13 (54.2)</td>
<td>0.5647</td>
</tr>
<tr>
<td>Total Residents, hospice</td>
<td>2 (8.3)</td>
<td>3 (12.5)</td>
<td>0.6372</td>
</tr>
</tbody>
</table>

Note: MSSE = Multisensory Stimulation Environment, MCAL = Memory Care Assisted Living
*Statistically significant p < 0.05

**Total residents.** A total of 13 residents were documented to have fallen prior to the installation of the MSSE showing to be 54.2% of total residents who fell, occurred during the pretest. A total of 16 residents were reported to have experienced a fall after the installation of the MSSE revealing that 66.7% of total residents who fell, occurred in the posttest (see Table 3-4). A Comparison of Proportions test determined that the difference in the proportion of total number of residents who fell pre- and post-intervention was not statistically significant, $X^2(1) = 0.768, p = 0.3809$.

**Total residents, non-hospice.** A total of 11 residents, excluding those receiving hospice services, experienced a fall comprising of 45.8% of total residents prior to the installation of the MSSE. A total of 13 residents, excluding those receiving hospice care, fell revealing 54.2% of this population experienced a fall following the MSSE installation (see Table 3-4). A Comparison of Proportions test determined that the difference in the proportion of total number of hospice
residents who fell pre- and post-intervention was not statistically significant, $X^2(1) = 0.332, p = 0.5647$.

**Total residents, hospice.** A total of 2 residents were receiving hospice services and experienced a fall comprising of 8.3% of total residents who fell prior to the installation of the MSSE. A total of 3 residents receiving hospice care fell revealing 12.5% of this population experienced a fall following the MSSE installation (see Table 3-4). A Comparison of Proportions test determined that the difference in the proportion of total number of hospice residents who fell pre- and post-intervention was not statistically significant, $X^2(1) = 0.222, p = 0.6372$.

**Discussion**

This study aimed to address the current gaps in literature studying an MSSE located on an MCAL unit intended for the independent use by ambulatory older adults diagnosed with dementia while receiving pharmacological treatment. We hypothesized that the installation of an open-floorplan MSSE design could impact patient behavior which may reduce the need to administer psychotropic medications and, in turn, reduce the number of resident falls. The results of this study do not reveal whether an MSSE contributes to the reduction of the number of psychotropic medications administered to older adults residing in an MCAL.

The analysis of the prescribed psychotropic medications revealed that the MSSE may have had a positive impact on the psychotropic medication dose reductions in the pretest/posttest. In a similar study involving the psychotropic medication reduction in 1653 residents diagnosed with dementia living in 45 different nursing homes, the dose reduction of psychotropic medications was evident when presented with three different nonpharmacological interventions (Weeks
et al., 2019). While falls did increase in this study, the interventions analyzed in the Weeks et al. (2019) study did not show an increase in falls for residents.

In this study, 3 residents were provided end-of-life care with hospice services which may have had an impact on the increased number of falls experienced by these patients during the course of the study. The data in this study revealed that the increase in falls experienced by hospice patients in the pretest/posttest were statistically significant and did contribute to the overall impact of total resident falls for the study group. Commonly referred to as “terminal restlessness”, patients receiving hospice services for end-of-life care will experience delirium, anxiety, chronic panic, restlessness, and seizures (Finucane, Lugton, Kennedy, & Spiller, 2017; Kamell & Smith, 2016). In addition, while benzodiazepines are used to treat the symptoms during end-of-life care for the older adult, the patient is subject to increased risks for falls, accidents, and hip fractures (Kamell & Smith, 2016).

The limitations of the present study include the inability to generalize the open-floorplan design in other MCAL settings as any alterations in floorplan, subject population, physician preference in medication management, and caregiver population may alter results. This study did not control for the number of employees working on the unit per shift or calculate for industry standard staffing ratios to care for this population which may have had an effect on the number of falls reported in this study both in the pretest and posttest. Further, the layout and design of the MCAL unit may have played a role in number of resident falls since the distance of a resident room from the common-areas, wayfinding colors and themes, and lighting of the unit were not controlled in this study. Other limitations of this study relate to the level of severity that a new resident moving into the MCAL may differ from the previous resident exiting the sample group which may have impacted the total number of psychotropic medications and residents’ functional
status of the aggregated data collected for analysis. The present study did not control for the amount of time subjects utilized the MSSE as an intervention. Moreover, the present study did not monitor the number of times a subject may have entered or exited the MSSE space on each shift. Some possible confounders of the present study requiring future research include potential conflicting stimuli occurring outside of the designated MSSE space which could impact outcomes by increasing or decreasing BPSD which may have impacted the administration of psychotropic medication to treat symptoms. Conflicting stimuli may be defined as sound and movement activity taking place adjacent to the MSSE space which could be distracting to the subject utilizing the MSSE. Additionally, biomedical factors were not controlled for the purposes of this study. Biomedical factors that could impact BPSD episodes and terminal restlessness include medication changes, physical pain, illnesses, seizures, and hallucinations. Likewise, the subjects reaching end-of-life may have played a role as a potential confounder in the overall results due to the decreased engagement and utilization of the MSSE intervention as functional abilities and performance skills would have been declining during the study. Another factor potentially affecting validity in this study may be the inconsistent documentation of falls and administration of psychotropic medications. Specific factors that may have impacted results are potential errors when staff documented witnessed or unwitnessed falls which could have taken place after a resident self-reported a fall. Moreover, the administered psychotropic medications documented in the medication administration record were analyzed in this study, which could have altered results if documentation was incorrect. Furthermore, the study population in this analysis was mostly homogenous with 23 White, non-Hispanic, and 1 White, Hispanic, residents living in the MCAL. The present study showed improvement in dose reductions of psychotropic medications but results may be variable when analyzed within a more heterogenous sample of
differing socioeconomic statuses. The perceptions of medication management for older adults diagnosed with dementia differ in underrepresented groups as participants indicate a certain level of skepticism as a result of historical exploitation by researchers and a distrusted health-care system leading to the added distrust of new technology treatments for certain populations (Gaugler, McCarron, & Mitchell, 2019). The open-floorplan MSSE can be easily identified as a new technology with equipment to stimulate the senses and the automated settings of the sensory equipment installed in the space. This intervention may reveal varying outcomes when installed in different regions of the U.S. due to the perception of the research study itself, sensory equipment used, how psychotropic medication is administered, or how the patient is medically managed within an Assisted Living Facility.

In summary, this research addressed gaps in the literature by studying the independent use and outcomes of an open-floorplan MSSE design located in an MCAL facility. This work builds upon existing research by revealing that an MSSE did potentially show impact on the dose reductions of psychotropic medications. However, the MSSE did not reveal to have impact on the prevalence of falls and the number of psychotropic medications administered to treat older adults diagnosed with dementia. This study did show that there is a need for further research on residents receiving end-of-life care as falls were shown to increase as more residents were added to hospice care. However, more work on this topic is needed.

**Conclusion**

This study represented an analysis of an open-floorplan MSSE to reveal its impact on the administration of psychotropic medications and the prevalence of falls experienced by older adults diagnosed with dementia living in an MCAL. This study shows that psychotropic medications,
prevalence of total falls, and PRN administration were not impacted with an MSSE located on an MCAL unit. However, the psychotropic medication dose reduction data showed improvement with a reduction in the dosage of psychotropic medications in the study. Additionally, while total falls were not shown to be impacted by the installation of an MSSE, the increase in falls experienced by hospice patients was found to be significant.

We recommend additional studies are needed of the MSSE with an open-floorplan design for persons diagnosed with dementia in order to add to the evidence-based research needed to continue to support greater adoption of the MSSE’s in MCAL settings. Additionally, the length of time studying the MSSE in MCAL settings should be extended in an effort to reveal longer term impact of the intervention. Further, studies are recommended to be conducted on the impact of an MSSE as an intervention for hospice patients and settings without hospice patients within the sample population. Moreover, studying the open-floorplan MSSE within facilities located in regions of varying socioeconomic status, sub-culture, and within underrepresented groups are recommended to expand the generalizability of the intervention, especially in resource-poor environments and communities. Finally, additional interdisciplinary contributions to the planning and design process (such as adding further clinical, architectural, and therapeutic insights) may improve the MSSE intervention for persons diagnosed with dementia.

References


CHAPTER IV

THE IMPACT OF AN OPEN-FLOORPLAN MULTISENSORY STIMULATION ENVIRONMENT DESIGN ON EMPLOYEE OUTCOMES FOR A MEMORY CARE ASSISTED LIVING FACILITY

Background and Significance

The population of older adults is rapidly growing with persons 65 and older in the United States (U.S.) increasing from 43.1 million in 2012 to 83.7 million by 2050 (Ortman, Velkoff, & Hogan, 2014). Additionally, an estimated 4.75 million people with dementia existed in North America in 2015 with this population projected to climb to 7.28 million by 2030 and 11.74 million by 2050 (Alzheimer’s Disease International, 2015). At the same time, the U.S. is projected to experience a shortage of nurses which will only intensify as the aging population (including cases of dementia diagnoses) grows along with a higher demand for a specialized health care workforce (Chenoweth, Jeon, Merlyn, & Brodaty, 2010; Rosseter, 2019). The demand for nurses is projected to grow by more than 200,000 job openings each year from 2016 to 2026 with nursing school programs reporting an insufficient supply of students to meet the projected demands for current and future nursing services (Rosseter, 2019; Torpey, 2018). Further, the nursing shortage creates challenges for frail older adults, including those diagnosed with dementia, and those operating Assisted Living Facilities (ALF) requiring providers to become innovative with new technologies in an effort to continue to provide care and support services to the older adult population (Gleckman, 2018).

Individuals diagnosed with dementia may be categorized by any of the following conditions: Alzheimer’s disease, vascular dementia, Dementia with Lewy bodies (DLB), mixed
dementia, Parkinson’s disease, Frontotemporal lobar degeneration (FTLD), Creutzfeldt-Jakob disease, normal pressure hydrocephalus, Huntington’s disease, and Wernicke-Korsakoff Syndrome (Alzheimer’s Association, 2017). Caring for older adults with these varying forms of dementia requires direct supervision by care providers. These providers may include relatives, hired private-duty caregivers, and personnel who work in long-term care facilities such as ALFs and Skilled Nursing Facilities (SNF). Caregivers working in an ALF may be unlicensed personnel with specific training provided by the facility, a Certified Nursing Assistant (CNA), or a licensed nurse.

Individuals diagnosed with dementia often display behavioral symptoms such as aggressiveness, wandering, depression, agitation, anxiety, repetitive activity, and nighttime disturbances. These are collectively referred to as Behavioral and Psychological Symptoms of Dementia (BPSD) (Alzheimer’s Association, 2017). Observation studies reveal that persons diagnosed with dementia often experience BPSD due to sensory deprivation, particularly those who are institutionalized, and consequently often experience intra-psychic discomfort due to imbalances in sensory-stimulation (Sánchez, Millán-Calenti, Lorenzo-Lopez, & Maseda, 2013).

In the 1970s, a Snoezelen® room was a coined term to describe a Multisensory Simulation Environment (MSSE) which was developed and utilized in the Netherlands to stimulate the senses in children with learning disabilities (Bauer et al., 2015). Over the years, research has shown that an MSSE serves as an effective nonpharmacological intervention compared to antipsychotic medication by providing a stress-reducing as well as entertaining environment for older adults diagnosed with dementia with the use of sensory elements to promote relaxation and stimulation (Sánchez et al., 2013). Moreover, pharmacological interventions, such as antipsychotics, show to be ineffective in controlling symptoms of BPSD, and an MSSE treatment room is an
example of a nonpharmacological intervention that shows promise (Sánchez et al., 2013). MSSEs are traditionally used as an alternative therapeutic intervention for BPSD by reducing maladaptive behaviors, promoting positive behaviors, increasing positive mood, promoting a caregiving relationship, and reducing caregiver stress (Milev et al., 2008). While there is no formal standard in the design of an MSSE, these treatment rooms commonly include low lighting with objects catering to the human senses such as aroma, sound, water columns, fiber-optic lighting, textured materials, and screen projection with costs ranging from $10,000 to $30,000 or higher depending on the type of equipment used (Bauer et al., 2015; Milev et al., 2008). Milev et al. (2008) reported findings from a 24-week study of 29 subjects that persons with dementia receiving weekly MSSE treatments presented improved outcomes in observed behavior observation, as well as positive outcomes for decreased behaviors which were maintained following cessation of the program. Specific modalities often included within MSSE treatments, such as aroma therapy and bright light therapy, have also been shown to be successful at managing behavioral problems (Milev et al., 2008). Research of MSSEs as an alternative intervention for reducing neuropsychiatric symptoms and dementia severity suggests that it is more effective than one-to-one activity sessions with care staff (Sánchez et al., 2016).

Existing literature describe the use of an MSSE requiring a caregiver to individually escort the patient to the MSSE treatment room, with the caregiver then required to spend time with the subject until the duration of the treatment is met. Due to continued shortages of the nursing workforce in the U.S., it is neither feasible nor reliable to continue to provide an undetermined amount of a sole caregiver’s time to patients experiencing BPSD as this process removes the staff member from the ability to provide care to other patients. Normally, MSSE
designs are located in an isolated room with a door to prevent access from other residents or patients of an ALF or SNF while the MSSE is in use.

In a study investigating caregiver burden, Kamiya, Sakurai, Ogama, Maki, and Toba (2014) state that the behavior disturbance and increased mobility of a resident with the diagnosis of dementia may increase burden and stress due to the extra attention and supervision required. Kamiya et al. (2014) further suggest that non-compliance with medication may cause caregiver mental stress and that the prevention of BPSD is an essential consideration in the management of dementia diagnoses. Literature on employee stress also explains that factors such as high turnover, absenteeism, low job satisfaction, and burnout reduce the quality and effectiveness of patient care in nursing homes (Islam, Baker, Huxley, Russell, & Dennis, 2017). As a result of caregiver burden as described by Kamiya et al. (2014), staffing turnover increases while employee engagement and satisfaction scores are negatively impacted. Additionally, employee engagement within an organization plays a significant role in turnover rates as engaged employees may be more likely to remain committed to their current place of employment and demonstrate to be 1.3 times more likely to be high performers than less engaged employees (Vance, 2006). Following a study of 600 ALFs, employee turnover rates across all positions were reported at 32% with rates reported at 33% for resident assistants/personal care aides and 27% turnover for LPNs in 2018 (Bowers, 2018).

Current studies do not reveal whether an MSSE can be effective at reducing staff turnover rates and improving employee engagement and satisfaction scores when installed in a Memory Care Assisted Living (MCAL) facility. Moreover, peer-reviewed literature is not available to show whether an open-floorplan MSSE design, built within an MCAL, can be effective at improving employee outcomes.
Purpose of the Study

In this study, an MSSE was designed and located in an existing common-area within a secure MCAL unit intended to be easily accessible by the residents of the unit. This MSSE intervention provides both calming and stimulating sensory elements for older adults diagnosed with dementia. The purpose of this study was to examine the employee turnover and employee engagement rates with the use of an open-floorplan MSSE as a nonpharmacological intervention for older adults diagnosed with dementia residing in an MCAL facility.

Methods

This study was conducted using a secondary, aggregated, data analysis of the human resources records of a single site 6 months prior to the build and use of an MSSE located in an MCAL center, and the secondary data was analyzed up to 6 months following the installation. The analysis of 6 months of caregiver turnover rates prior to the installation of the open-floorplan MSSE serves as the control for this study while the 6 months of turnover rates following the installation will serve as the comparison group. Additional data—including the employee engagement survey released in 2017—serves as the control for this study while the employee engagement survey released in 2019 serves as the comparison group. Employee records included documentation of the total number of terminated employees for twelve months of staff members exclusively employed at an MCAL facility located in the United States Midwest region.

Participants

The data for this study were obtained from secondary, aggregated, data retrieved from the human resources records of staff members employed by the MCAL facility (n = 46). The analysis
took place over a 12-month period from September 1, 2017 to August 31, 2018 with installation of the MSSE taking place in March of 2018. The MCAL site used for this study employed a Nursing Services Manager \( (n = 1) \), a Community Director \( (n = 1) \), Care Assistants \( (n = 30) \), Medication Assistants \( (n = 7) \), Housekeeping/Laundry Assistants \( (n = 3) \), Licensed Practical Nurses (LPN) \( (n = 2) \), a Life Enrichment Coordinator \( (n = 1) \), and a Cook \( (n = 1) \) during the time of this study. Each staff member is assigned an employment status of either full-time \( (n = 14) \), part-time \( (n = 20) \), or on-call employee \( (n = 12) \). The average amount of time employees of the MCAL worked for the unit was approximately 4 years and 47 days \( (M = 4.13) \) (see Table 4-1).

Table 4-1

Descriptive Statistics of Participants

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<tr>
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<th>Years employed by MCAL</th>
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<th>( SD )</th>
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<th>Max</th>
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<th>( M ) (in years)</th>
<th>( SD )</th>
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<td>3.82</td>
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<td>5.78</td>
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<td>Housekeeping/Laundry Assistant</td>
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<td>7</td>
<td>6.68</td>
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<td>19.75</td>
</tr>
<tr>
<td>LPN</td>
<td>2</td>
<td>5</td>
<td>8.43</td>
<td>0.71</td>
<td>7.93</td>
<td>8.93</td>
</tr>
<tr>
<td>Community Director</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursing Services Manager</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life Enrichment Coordinator</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cook</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. \( M \) = Mean, \( SD \) = Standard deviation, Min. = Minimum value, Max. = Maximum value
The study population were employed to work exclusively for the MCAL facility. Staff members of the MCAL facility were trained to care for the patient population diagnosed with dementia.

Monthly turnover of staff assigned to work at the MCAL was calculated using the formula recommended by the Society of Human Resource Management (SHRM): Turnover rate = Number of Separations / Average Number of Employees x 100 (Society for Human Resource Management, n.d.). Total turnover of staff pre-MSSE installation and post-MSSE installation was calculated using the Annual Turnover Rate (TR) formula: Turnover rate = Month 1 TR + Month 2 TR + Month 3 TR + . . . + Month 6 TR (Society for Human Resource Management, n.d.).

The employee satisfaction and engagement scores were calculated by a third-party firm, Holleran Community Research and Consulting, following the voluntary completion by MCAL employees. The employees were placed into five different categories, terms devised by Holleran, as a result of the responses provided which were titled Catalysts, Advocates, Endorsers, Contributors, and Resistors. The Catalyst and Advocate categories are described as highly engaged and radically committed employees to the organizational success, while the Endorsers and Contributors are described as those who show up and do their job with the majority of this group being satisfactory employees but may not make sacrifices for the organization, and the Resistors are defined as those who are least engaged displaying typical signs which may be of detriment to the culture and progress of the organization (Holleran, 2017, 2019). More specifically, Catalysts are described as Change Agents, Advocates as Cheerleaders, Endorsers as Hard Workers, Contributors as Reliable Producers, and Resistors were described as Daily Antagonists (Anthony, 2019). The
satisfaction responses for employees were based on a 5-point Likert Scale ranging from 1 to 5 with 1 labeled as “Strongly Disagree” to 5 being “Strongly Agree” which then provided a mean score of satisfaction from respondents of the satisfaction surveys from March 2017 to March 2019 (Holleran, 2017, 2019).

Procedure

This study analyzed employee turnover calculated each month based on the average number of staffs employed and total employee terminations. The data collected is analyzed in two ways: as those specifically employed by the MCAL unit and the health care organization across all units, non-specific MCAL employees, including the total number of employees working for the company which may be employees of the SNF, AL, and Independent Living (IL) departments. The purpose of showing the MCAL specific-data and the overall employee responses from the organization serves as a comparison of culture and employee engagement between units. This study also analyzed staff engagement and satisfaction scores for 2017 and 2019 from the facility’s Human Resources department employment records. The satisfaction and engagement surveys were distributed by the MCAL facility to the employees in a written and online format for voluntary completion in March 2017 and March 2019 and were submitted back, by the employee, to a third-party firm, Holleran Community Research and Consulting, for anonymous analysis of the responses. The distribution of the employee engagement survey is common practice for the MCAL facility, once every two years, for operational benchmarking and analysis of employee satisfaction and quality improvement. Holleran Community Research and Consulting is a third-party firm specializing in the development of comprehensive surveys and reports for not-for-profit senior care organizations which come complete with comparison
analyses against over 59,000 senior living employee surveys across the U.S. (“Holleran Community Engagement Research and Consulting,” 2019).

**Environment design.** The MSSE was created as an open-floorplan design located in a common-area of the MCAL secured unit which housed twenty apartments for older adults diagnosed with dementia and meeting criteria identified by the MCAL care providers. This MSSE was designed to permit residents of the MCAL to voluntarily enter and exit the MSSE at any time without the closure of a door or walls to enclose the treatment space. This design was created with the goal to reduce the need for care providers to escort a resident to utilize the space with the additional benefit of the location of the MSSE, allowing care providers to have the ability to view the resident’s use of the space from a distance to monitor the safety of the resident. The MSSE space was built to include only one or two sensory elements per sensory category to reduce potential for over-stimulation in the space.

The MSSE integrated five sensory categories including aroma therapy with a lavender scent diffuser. No other scents were used during the course of this study in order to maintain control of the aroma stimulant for the MSSE. The MSSE was designed to be fully automated by utilizing aroma therapy equipment that activated automatically.

The visual stimulation element included LED up-lighting that projected up the walls of the space as well as low-lighting installed in the ceiling of the MSSE. This lighting was programmed to change at certain times of day reducing the need for care providers to interact with the equipment. Settings for the lighting were pre-set to “Relax-mode”, “Uplift”, “Evening”, and “Daytime” which corresponded to color related to the intended mood.
Audible elements were provided by an internal sound system which could play soothing and stimulating sound sequences at the discretion of the care provider activating the sound system. The sound system for this room was recessed into the ceiling of the room.

The tactile elements of the MSSE included varying textures of furniture and fabric carefully selected for the room. These tactile pieces included wooden furniture, tiled surfaces on coffee and side tables, wicker chairs, canvas and polyester textured pillows, as well as a brick wall, PVC railing which mimicked a picket fence, and glass windows.

Finally, the vestibular element was achieved with the placement of rocking chairs and glider chairs in the room. These chairs were accessible by the subjects without the need for assistance from a care provider to transfer to the seat for use.

**Variables.** The open-floorplan MSSE design located on the MCAL secured unit served as the independent variable for this study. The employee turnover reports and the employee engagement scores served as the dependent variables in this pretest-posttest analysis.

**Results**

The data retrieved from the employee records revealed that the total turnover rate prior to the installation of the MSSE on the MCAL unit from September 2017 to February 2018 was 41.78% and a total turnover rate post-MSSE installation between March 2018 to August 2018 was 12.92%. The average number of employees working in the MCAL during the six months prior to the MSSE installation as well as the average number of employees during the six months post-MSSE installation remained constant at 30.83 employees with a total of 13 employees terminated, either voluntarily or involuntarily, prior to installation and 4 employees terminated post-installation. The non-specific MCAL total employee turnover data was 29.72% prior to the MCAL
MSSE installation and 29.15% post-installation (see Table 4-2). A Comparison of Proportions test determined that the difference in the proportion of employee turnover rates calculated pre- and post-MSSE installation on the MCAL unit was statistically significant, $X^2(1) = 6.392, p = 0.0115$.

Table 4-2

*Employee Turnover Rates with MSSE Installation Pretest/Posttest*

<table>
<thead>
<tr>
<th></th>
<th>Employee headcount $\bar{M}$</th>
<th>New hires $n$</th>
<th>Terms $n$</th>
<th>MCAL Unit TO (%)</th>
<th>Non-specific MCAL Unit TO (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-MSSE installation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>30</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4.65</td>
</tr>
<tr>
<td>October</td>
<td>31</td>
<td>1</td>
<td>3</td>
<td>9.68</td>
<td>6.26</td>
</tr>
<tr>
<td>November</td>
<td>33</td>
<td>5</td>
<td>3</td>
<td>9.09</td>
<td>4.27</td>
</tr>
<tr>
<td>December</td>
<td>31</td>
<td>1</td>
<td>3</td>
<td>9.68</td>
<td>6.13</td>
</tr>
<tr>
<td>January</td>
<td>30</td>
<td>2</td>
<td>2</td>
<td>6.67</td>
<td>6.27</td>
</tr>
<tr>
<td>February</td>
<td>30</td>
<td>2</td>
<td>2</td>
<td>6.67</td>
<td>2.13</td>
</tr>
<tr>
<td>Post-MSSE installation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>30</td>
<td>2</td>
<td>1</td>
<td>3.33</td>
<td>2.85</td>
</tr>
<tr>
<td>April</td>
<td>30</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>5.08</td>
</tr>
<tr>
<td>May</td>
<td>30</td>
<td>0</td>
<td>1</td>
<td>3.33</td>
<td>4.63</td>
</tr>
<tr>
<td>June</td>
<td>31</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>5.25</td>
</tr>
<tr>
<td>July</td>
<td>32</td>
<td>1</td>
<td>2</td>
<td>6.25</td>
<td>5.75</td>
</tr>
<tr>
<td>August</td>
<td>32</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5.59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Intervention</th>
<th>MCAL Unit Total TO (%)</th>
<th>Non-specific MCAL Unit Total TO (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-MSSE installation</td>
<td>41.78</td>
<td>29.72</td>
</tr>
<tr>
<td></td>
<td>Post-MSSE installation</td>
<td>12.92*</td>
<td>29.15</td>
</tr>
</tbody>
</table>

**Note.** $M =$ Mean, $Terms =$ Voluntary or involuntary employee terminations, $TO =$ Turnover, $MC =$ Memory Care Assisted Living, $MSSE =$ Multisensory Stimulation Environment, Non-specific $MCAL =$ All other departments of the aging services organization excluding the $MCAL$

*Statistically significant $p < 0.05$
Data retrieved from the employee engagement surveys distributed in March 2017 and March 2019 serve as reports pre- and post-MSSE installation of employees’ engagement levels while employed by the MCAL and the health care organization across all units. The March 2017 employee engagement survey was completed by 12 MCAL employees while 15 employees completed the March 2019 survey. Employees were assigned one of five different categories of engagement level following a series of questions answered by the employee. These categories were titled Catalysts, Advocates, Endorsers, Contributors, and Resistors. The highest variance in positive change was improvement in the Endorser category with a 14.8% increase. The second highest change in classification was a 4.5% increase in the number of employees categorized as a Catalyst. The least amount of change was found in the Contributor category which was a 0.6% reduction in staff categorized by this classification (see Table 4-3). A Comparison of Proportions test determined that the difference in the proportion of employee engagement categorization as an Endorser identified pre- and post-MSSE installation on the MCAL unit was not statistically significant, $X^2(1) = 1.020, p = 0.3126$.

Data retrieved from the employee engagement surveys distributed in March 2017 and March 2019 serve as reports pre- and post-MSSE installation of employee’s satisfaction levels while employed by the MCAL. The March 2017 employee engagement survey was completed by 12 MCAL employees while 15 employees completed the March 2019 survey. The survey found that the employees of the MCAL responded with 88.0% of employees responding “Strongly Agree” on a 5-point Likert Scale as “Overall, I am satisfied with my job” in 2017 and 88.8% in 2019 (see Table 4-4). A Comparison of Proportions test determined that the difference in the proportion of employee satisfaction scores who responded “Strongly Agree” to “Overall, I am
satisfied with my job” pre- and post-MSSE installation on the MCAL unit was not statistically significant, \( X^2(1) = 0.004, p = 0.9494 \).

Table 4-3

*Employee Engagement Survey Results Depicting Engagement Category*

<table>
<thead>
<tr>
<th>Engagement Category</th>
<th>March 2017 MCAL Unit ((n = 12))</th>
<th>March 2019 MCAL Unit ((n = 15))</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalysts</td>
<td>41.7%</td>
<td>46.2%</td>
<td>+ 4.5%</td>
</tr>
<tr>
<td>Advocates</td>
<td>25.0%</td>
<td>15.4%</td>
<td>- 4.6%</td>
</tr>
<tr>
<td>Endorsers</td>
<td>8.3%</td>
<td>23.1%</td>
<td>+ 14.8%</td>
</tr>
<tr>
<td>Contributors</td>
<td>8.3%</td>
<td>7.7%</td>
<td>- 0.6%</td>
</tr>
<tr>
<td>Resistors</td>
<td>16.7%</td>
<td>7.7%</td>
<td>- 9.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Engagement Category</th>
<th>March 2017 Non-specific MCAL Unit ((N = 288))</th>
<th>March 2019 Non-specific MCAL Unit ((N = 282))</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalysts</td>
<td>25.8%</td>
<td>33.9%</td>
<td>+ 8.1%</td>
</tr>
<tr>
<td>Advocates</td>
<td>19.4%</td>
<td>20.6%</td>
<td>+ 1.2%</td>
</tr>
<tr>
<td>Endorsers</td>
<td>18.3%</td>
<td>13.7%</td>
<td>- 4.6%</td>
</tr>
<tr>
<td>Contributors</td>
<td>15.1%</td>
<td>13.7%</td>
<td>- 1.4%</td>
</tr>
<tr>
<td>Resistors</td>
<td>21.4%</td>
<td>18.1%</td>
<td>- 3.3%</td>
</tr>
</tbody>
</table>

*Note.* Engagement categories are titled and defined by Holleran Community Research and Consulting.
Table 4-4

Employee Engagement Survey Results Pretest/Posttest

<table>
<thead>
<tr>
<th>Statement</th>
<th>March 2017 MCAL Unit (n = 12) (%)</th>
<th>March 2019 MCAL Unit (n = 15) (%)</th>
<th>Variance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall, I am satisfied with my job.</td>
<td>88.0</td>
<td>88.8</td>
<td>0.8</td>
</tr>
<tr>
<td>I would recommend as a great place to work.</td>
<td>88.6</td>
<td>91.8</td>
<td>3.2</td>
</tr>
<tr>
<td>I think I will be working here in three years.</td>
<td>72.9</td>
<td>77.6</td>
<td>4.7</td>
</tr>
<tr>
<td>I believe this company is living up to its mission and goals.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At work, my opinions count.</td>
<td>77.3</td>
<td>76.6</td>
<td>-0.7</td>
</tr>
<tr>
<td>This company cares for its employees.</td>
<td>77.3</td>
<td>87.0</td>
<td>9.7</td>
</tr>
<tr>
<td>At work, I have the opportunity to do what I do best every day.</td>
<td>90.7</td>
<td>86.6</td>
<td>-4.1</td>
</tr>
<tr>
<td>I Trust the leadership of this company.</td>
<td>76.0</td>
<td>82.4</td>
<td>6.4</td>
</tr>
<tr>
<td>I feel I’m part of a team that is producing meaningful results for the organization.</td>
<td>84.0</td>
<td>86.6</td>
<td>2.6</td>
</tr>
<tr>
<td>I feel I personally make a difference here.</td>
<td>92.0</td>
<td>93.4</td>
<td>1.4</td>
</tr>
<tr>
<td>I often leave work feeling food about the work I did.</td>
<td>91.4</td>
<td>88.8</td>
<td>-2.6</td>
</tr>
<tr>
<td>I have friends at work.</td>
<td>88.0</td>
<td>88.2</td>
<td>0.2</td>
</tr>
<tr>
<td>I know what is expected of me.</td>
<td>92.0</td>
<td>94.4</td>
<td>2.4</td>
</tr>
<tr>
<td>My supervisor offers positive recognition for a job well done.</td>
<td>84.0</td>
<td>88.8</td>
<td>4.8</td>
</tr>
<tr>
<td>This last year, I have had opportunities at work to learn and grow.</td>
<td>82.7</td>
<td>82.6</td>
<td>-0.1</td>
</tr>
<tr>
<td>The physical safety of employees is protected.</td>
<td>86.7</td>
<td>82.4</td>
<td>-4.3</td>
</tr>
<tr>
<td>Staff issues, including conflicts, are resolved fairly.</td>
<td>81.3</td>
<td>78.8</td>
<td>-2.5</td>
</tr>
<tr>
<td>The workload of my team is distributed fairly.</td>
<td>76.0</td>
<td>77.6</td>
<td>1.6</td>
</tr>
<tr>
<td>I am given the necessary tools and equipment to do my job.</td>
<td>84.0</td>
<td>83.4</td>
<td>-0.6</td>
</tr>
<tr>
<td>I believe our employees provide residents with the best possible care.</td>
<td>90.7</td>
<td>83.4</td>
<td>-7.3</td>
</tr>
<tr>
<td>I have respect for my supervisor.</td>
<td>90.7</td>
<td>93.4</td>
<td>2.7</td>
</tr>
<tr>
<td>I am given training on all the important parts of my job.</td>
<td>85.3</td>
<td>85.8</td>
<td>0.5</td>
</tr>
<tr>
<td>My performance review is completed and shared with me on time.</td>
<td>77.1</td>
<td>87.8</td>
<td>10.7</td>
</tr>
<tr>
<td>I am paid a competitive wage compared to similar positions in the industry.</td>
<td>60.0</td>
<td>67.6</td>
<td>7.6</td>
</tr>
<tr>
<td>The employee benefits package covers my needs.</td>
<td>80.0</td>
<td>70.6</td>
<td>-9.4</td>
</tr>
<tr>
<td>I am passionate about the work I am currently doing.</td>
<td>96.0</td>
<td>96.6</td>
<td>0.6</td>
</tr>
<tr>
<td>I can achieve my career goals with this organization.</td>
<td>78.6</td>
<td>82.6</td>
<td>4.0</td>
</tr>
</tbody>
</table>
### Table 4-4, continued

<table>
<thead>
<tr>
<th></th>
<th>March 2017 Non-specific MCAL Unit ($n = 288$) (%)</th>
<th>March 2019 Non-specific MCAL Unit ($n = 282$) (%)</th>
<th>Holleran National Benchmark Mean (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall, I am satisfied with my job.</td>
<td>81.5</td>
<td>88.8</td>
<td>83.4</td>
</tr>
<tr>
<td>I would recommend as a great place to work.</td>
<td>81.7</td>
<td>91.8</td>
<td>82.6</td>
</tr>
<tr>
<td>I think I will be working here in three years.</td>
<td>75.0</td>
<td>77.6</td>
<td>77.2</td>
</tr>
<tr>
<td>I believe this company is living up to its mission and goals.</td>
<td>75.4</td>
<td>88.8</td>
<td>79.6</td>
</tr>
<tr>
<td>At work, my opinions count.</td>
<td>71.0</td>
<td>76.6</td>
<td>74.4</td>
</tr>
<tr>
<td>This company cares for its employees.</td>
<td>75.9</td>
<td>87.0</td>
<td>77.6</td>
</tr>
<tr>
<td>At work, I have the opportunity to do what I do best every day.</td>
<td>82.2</td>
<td>86.6</td>
<td>83.4</td>
</tr>
<tr>
<td>I Trust the leadership of this company.</td>
<td>72.8</td>
<td>82.4</td>
<td>76.6</td>
</tr>
<tr>
<td>I feel I’m part of a team that is producing meaningful results for the organization.</td>
<td>79.7</td>
<td>86.6</td>
<td>80.8</td>
</tr>
<tr>
<td>I feel I personally make a difference here.</td>
<td>86.9</td>
<td>93.4</td>
<td>84.8</td>
</tr>
<tr>
<td>I often leave work feeling good about the work I did</td>
<td>83.5</td>
<td>88.8</td>
<td>85.4</td>
</tr>
<tr>
<td>I have friends at work.</td>
<td>84.1</td>
<td>88.2</td>
<td>81.8</td>
</tr>
<tr>
<td>I know what is expected of me.</td>
<td>86.2</td>
<td>94.4</td>
<td>87.8</td>
</tr>
<tr>
<td>My supervisor offers positive recognition for a job well done.</td>
<td>79.3</td>
<td>88.8</td>
<td>79.8</td>
</tr>
<tr>
<td>This last year, I have had opportunities at work to learn and grow.</td>
<td>76.4</td>
<td>82.6</td>
<td>79.0</td>
</tr>
<tr>
<td>The physical safety of employees is protected.</td>
<td>80.2</td>
<td>82.4</td>
<td>82.6</td>
</tr>
<tr>
<td>Staff issues, including conflicts, are resolved fairly.</td>
<td>68.5</td>
<td>78.8</td>
<td>72.6</td>
</tr>
<tr>
<td>The workload of my team is distributed fairly.</td>
<td>67.4</td>
<td>77.6</td>
<td>72.2</td>
</tr>
<tr>
<td>I am given the necessary tools and equipment to do my job.</td>
<td>76.4</td>
<td>83.4</td>
<td>80.8</td>
</tr>
<tr>
<td>I believe our employees provide residents with the best possible care.</td>
<td>79.5</td>
<td>83.4</td>
<td>84.8</td>
</tr>
<tr>
<td>I have respect for my supervisor.</td>
<td>86.5</td>
<td>93.4</td>
<td>87.2</td>
</tr>
<tr>
<td>I am given training on all the important parts of my job.</td>
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<td>85.8</td>
<td>81.2</td>
</tr>
<tr>
<td>My performance review is completed and shared with me on time.</td>
<td>69.3</td>
<td>87.8</td>
<td>77.8</td>
</tr>
<tr>
<td>I am paid a competitive wage compared to similar positions in the industry.</td>
<td>58.4</td>
<td>67.6</td>
<td>69.0</td>
</tr>
<tr>
<td>The employee benefits package covers my needs.</td>
<td>73.2</td>
<td>70.6</td>
<td>75.2</td>
</tr>
<tr>
<td>I am passionate about the work I am currently doing.</td>
<td>88.1</td>
<td>96.6</td>
<td>88.8</td>
</tr>
<tr>
<td>I can achieve my career goals with this organization.</td>
<td>72.7</td>
<td>82.6</td>
<td>76.6</td>
</tr>
</tbody>
</table>

**Note.** Satisfaction survey questions were selected by Holleran Community Research and Consulting and compared to results retrieved from long term care organizations.
Discussion

This study aimed to address the current gaps in the literature of an MSSE located on an MCAL unit intended for the independent use by ambulatory older adults diagnosed with dementia. We hypothesized that the installation of an open-floorplan MSSE design could reduce the employee turnover rate while improving employee engagement and satisfaction. Typically, MSSEs are not designed so that an older adult with dementia is able to enter and exit the room voluntarily. MSSEs in MCAL settings are commonly located in a room with a door and do not encourage use without the direct supervision of a caregiver. The results of this study suggest that the installation of this open-floorplan MSSE positively impacted the employee turnover rate as a result of providing a nonpharmacological intervention to older adults which did not require added burden or workload to the employee. However, this study did not suggest that the MSSE had an impact on employee engagement or satisfaction scores.

The Bureau of Labor Statistics reported that the local unemployment rate at the beginning of the study in September 2017 was 4.1% and decreased to 3.5% by the end of the study in August 2018 while national rates were 3.8% at its lowest during the MSSE analysis period (Bureau of Labor Statistics, 2019a, 2019b). The Bureau of Labor Statistics (2019a) illustrates that 6,922 people living in Kalamazoo were unemployed at the beginning of the study which dropped to 5,809 people by the end of the study. With a below average local unemployment rate, it could be assumed that the MCAL facility experienced greater challenges to fill employee vacancies as well as the possibility that staff would have various opportunities to work for local competition.
The minimum direct cost of employee turnover per worker is estimated to be $2,500 comprising of costs associated with recruiting and training new employees as well as costs of separation and vacancy (Farrell & Dawson, 2014). If we consider the methodology of Farrell and Dawson (2014), this MCAL location incurred $32,000 in expense for the turnover of 13 employees in the 6 months prior to the installation of the MSSE while only $10,000 in expenses were incurred with the loss of 4 employees in the 6 months following the installation.

Furthermore, this study revealed the differences in culture within the MCAL facility when compared to the health care organization as a whole. The results comparing the MCAL facility turnover rates to the health care organization across all units, non-specific MCAL, show that the turnover rate remained constant at 29% both pre- and post-MSSE installation which only took place in the MCAL facility. The assumption can be made that employee overall culture remained constant for the organization, as a whole, while pre- and post-MSSE installation turnover data was reduced from 41.78% to 12.92% in the MCAL when the intervention was in place for the older adults of the MCAL unit.

Employee engagement scores did not show to be statically significant for the pretest/posttest data of the MSSE on the MCAL unit or for non-specific MCAL data displaying the health care organization across all units. In a presentation delivered at the LeadingAge Association for Non-profit Aging Services conference in 2019, the national Holleran survey data revealed that highly engaged employees were three times less likely to leave their place of employment and the relationship between engagement and turnover shows that for every 12.5% increase in engagement, turnover is reduced by 3% (Anthony, 2019). In addition, Anthony (2019) further explains the findings of a multisite provider study that the most disengaged employees are 73% more likely to turnover within six months. The pretest/posttest data of this study show that engagement and
satisfaction scores did not fluctuate significantly for either the MCAL or the organization as a whole, which can be assumed that the culture remained constant for both the MCAL employees and the whole organization, non-specific MCAL, employees; thus, the MSSE installation may have added validity to the impact it had on the turnover rate reduction in the MCAL setting.

The limitations of the present study include the inability to generalize the open-floorplan design in other MCAL settings as any alterations in floorplan, subject population, and caregiver population may alter results. The present study did not control for the workload assigned to each employee, medical acuity and complexity of the patients, or the training each employee received for their assigned role. Moreover, this study did not monitor the reasons why an employee was terminated, whether voluntarily or involuntarily. Additionally, all employee engagement surveys released were not completed by all staff members which decreases the ability to analyze overall employee satisfaction within the MCAL facility. In 2017, there were an average of 30 employees working in the MCAL facility with only 12 having completed the surveys and a total of 420 employees across all units, non-specific MCAL, with only 288 completed surveys returned. In 2019, there were an average of 30 employees working in the MCAL facility with only 15 having completed the surveys and a total of 420 employees across all units, non-specific MCAL, with only 282 completed surveys returned. Possible confounders of the study requiring future research include staff satisfaction and perception of the effectiveness of the MSSE as a nonpharmacological intervention for the patients of the MCAL. Finally, the data of the employee socioeconomic status, race, and ethnicity was not analyzed or collected for the purposes of the present study. Different perceptions of caring for older adults with dementia may have alternate effects on the outcomes of employee turnover, employee satisfaction, and employee engagement that could be different than the present study. One example of a study conducted exploring the perspectives of African-
American caregivers with relation to behaviors exhibited by older adults with dementia reveals that African-American caregivers report less upset and more confidence managing aggressive BPSD episodes when compared to White caregivers (Hansen, Hodgson, & Gitlin, 2018). Hansen, Hodson, and Gitlin (2018) further explain that the African-American study population was able to remain calm when managing BPSD episodes and indicate that African-American caregivers have reported higher satisfaction and lower caregiver burden than when compared to white caregivers. This study reveals that the subject population of the employee participants could have played a role in the management of the older adult population and the workplace culture of satisfaction.

In summary, this research addressed gaps in the literature by studying the employee turnover, engagement, and satisfaction following the installation of an open-floorplan MSSE design located in an MCAL facility. This work builds upon existing research by revealing that an MSSE may improve patient outcomes which may reduce the caregiver burden and workload of an employee working in an MCAL facility. Moreover, this study contributes to research in the area of MSSE design and the impact it may have on those caring for older adults diagnosed with dementia. While MSSEs are becoming more prominent as a nonpharmacological intervention for the treatment of older adults diagnosed with dementia, more work on this topic is needed.

Conclusion

This study represented an analysis of an open-floorplan MSSE to reveal the effectiveness in its use as a nonpharmacological intervention reducing the need of a care provider to directly supervise an older adult diagnosed with dementia for the duration of a treatment session. This study reveals that staffing turnover rates decreased following the installation of an open-floorplan
MSSE located within the MCAL facility. However, employee engagement scores did not show significant improvement with the MSSE installed at the MCAL.

We recommend additional studies of the MSSE with an open-floorplan design for persons diagnosed with dementia and its relation to staff outcomes in order to add to the evidence-based research needed to continue to support greater adoption of the MSSE’s in MCAL settings. Additionally, the length of time studying the MSSE in MCAL settings should be extended in an effort to reveal longer term impact of the intervention and its impact on employee outcomes. Moreover, additional studies are recommended to determine socioeconomic differences in employee population and how the varying demographics of caregivers’ impact staff satisfaction, employee engagement, and staff turnover trends when caring for persons diagnosed with dementia. Finally, additional interdisciplinary contributions to the planning and design process (such as adding further clinical, architectural, and therapeutic insights) may improve the MSSE intervention for persons diagnosed with dementia and additional capabilities of reducing caregiver burden.

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CHAPTER V

CONCLUSION

Summary

This purpose of this three-paper dissertation was to examine the impact of an open-floorplan Multisensory Stimulation Environment (MSSE) with three studies which build upon each other to explore impact clinically and operationally within a Memory Care Assisted Living (MCAL) facility. With a higher demand for a specialized workforce to care for a growing population of older adults diagnosed with dementia, the need for nonpharmacological intervention with reduced staff and cost grows imminent (Chenoweth, Jeon, Merlyn, & Brodaty, 2010; Ortman, Velkoff, & Hogan, 2014; Rosseter, 2019). Studies have revealed that older adults taking psychotropic medications to treat Behavioral and Psychological Symptoms of Dementia (BPSD) experience negative outcomes as a result of increased falls and have been found to be ineffective in treatment (Bronskill et al., 2018; Hamza, Adly, Abdelrahman, & Fouad, 2019). The studies in this dissertation include the analysis of Behavioral and Psychological Symptoms of Dementia (BPSD), psychotropic medication use, and prevalence of falls for residents living within an MCAL facility. This dissertation also explored the impact the MSSE may have had on employee outcomes with relation to staff turnover, satisfaction scores, and employee engagement for those working in the MCAL.
Study One (Chapter II)

This study of 24 residents diagnosed with dementia residing in an MCAL, addressed gaps in literature by studying the independent use and outcomes of an open-floorplan MSSE design located in an MCAL facility. This work builds upon existing research by revealing that an MSSE may positively improve mood and behavior in older adults but with the added component that the older adult may utilize the MSSE without the need of a care provider to provide direct supervision while the space is in use. In this study, we hypothesized that an open-floorplan MSSE may be effective at reducing the number of BPSD episodes experienced by an older adult with dementia living in an MCAL facility without the need for one-to-one supervision by care staff. This study reveals that episodes of BPSD experienced by the residents were reduced and were found to be statistically significant when exposed to the open-floorplan MSSE.

Study Two (Chapter III)

This research of 24 residents diagnosed with dementia residing in an MCAL, represented an analysis of an open-floorplan MSSE to reveal its impact on the administration of psychotropic medications and the prevalence of falls experienced by older adults diagnosed with dementia living in an MCAL facility. This analysis builds upon the previous study by exploring whether the MSSE reduced the need for psychotropic medication to treat BPSD and we hypothesized that with decreased BPSD, psychotropic medications would reduce and subsequently reduce the prevalence of falls. This study shows that psychotropic medications, prevalence of total falls, and pro re nata (PRN), or “as needed”, administration was not impacted or statistically significant with an MSSE located on an MCAL unit. However, the psychotropic medication dose reduction data showed improvement and found to be statistically significant with a reduction in the dosage
of psychotropic medications in the study. Additionally, while total falls were not shown to be impacted or statistically significant by the installation of an MSSE, the increase in falls experienced by hospice patients was found to be statistically significant.

**Study Three (Chapter IV)**

This analysis of 46 MCAL employees represented a study of an open-floorplan MSSE to reveal the effectiveness in its use as a nonpharmacological intervention reducing the need of a care provider to directly supervise an older adult with dementia for the duration of a treatment session. We hypothesized that the decreased burden of one-to-one care needed to utilize the MSSE and decreased BPSD, from the previous study, would improve employee satisfaction, engagement, and decrease turnover ratios with the improvement of caregiver working conditions. This study reveals that staffing turnover rates decreased and were found to be statistically significant following the installation of an open-floorplan MSSE located within the MCAL facility. However, employee engagement scores did not show improvement or statistical significance with the MSSE installed at the MCAL.

**Limitations**

The limitations of this research include the inability to generalize the open-floorplan MSSE design in other MCAL settings as any alterations in floorplan, subject population, physician preference in medication management, and caregiver population may alter results. This study did not control for the amount of time subjects utilized the MSSE as an intervention. Moreover, the research did not monitor the number of times a subject may have entered or exited the MSSE space on each shift. A literature review of 18 studies, which took place over the
course of 22 years, reported the analysis of time spent in an MSSE ranged anywhere from 15 to 45 minutes and mostly resulted in immediate positive improvements in behaviors for older adults with dementia; however, the amount of time required to spend in an MSSE to achieve positive results did vary (Sánchez, Millán-Calenti, Lorenzo-López, & Maseda, 2013). The present study did not control for the patient care workload assigned to each employee, medical acuity and complexity of the patients, or the training each employee received for their assigned role. Additionally, this study did not monitor the reasons why an employee was terminated, whether voluntarily or involuntarily. Furthermore, all employee engagement surveys released were not completed by all staff members which decreases the ability to analyze overall employee satisfaction within the MCAL facility. Finally, this dissertation research did not study a multicultural patient population as the population was a homogenous group of 23 White, non-Hispanic, and 1 White, Hispanic, residents.

**Potential Confounders**

Possible confounders of these studies requiring future research include, but are not limited to, the potential of conflicting stimuli occurring outside of the designated MSSE space which could impact outcomes by increasing or decreasing BPSD episodes. Conflicting stimuli may be defined as any sound and movement taking place adjacent to the MSSE space which could be distracting to the subject utilizing the MSSE. In a study examining 93 older adults diagnosed with frontotemporal dementia, it was found that certain dementia related behaviors were not a result of anxiety or obsessive disorders but they were more often triggered by environmental stimuli (Moheb et al., 2019). The response to these stimuli may have also impacted the physician’s decision to prescribe psychotropic medications to treat symptoms.
Further, staffing routines and the locations of the staff among the unit may be a potential confounder as staffing levels change from shift to shift. The design of the unit itself could have played a role in the prevalence of resident falls with wayfinding wall and flooring colors chosen in the MCAL potentially impacting resident behavior. The type of flooring and transitions between rooms are also a factor that should be researched in greater detail as residents may be more likely to fall with different types of assistive devices while ambulating. Several potential confounders may have played a role throughout this study with relation to resident falls.

Biomedical factors were not controlled for the purposes of this study. Biomedical factors that were not controlled in this study but could impact BPSD episodes include medication changes, physical pain, illnesses, and hallucinations. In a systematic review involving 16 studies, results showed that pain interventions were effective in reducing the discomfort that leads to behaviors such as depression, agitation, aggression, and anxiety for older adults diagnosed with dementia (Pieper et al., 2013). In year-long study of 312 patients, findings revealed that the continuation of psychotropic medications was related to increased severity in BPSD episodes and care burden; however, the discontinuation of psychotropic medications decreased episodes and improved care burden showing that psychotropic medication fluctuations impact BPSD significantly (Ozaki, Katsumata, & Arai, 2019). In another study analyzing internal-stimuli effects, dementia-related behaviors often were triggered by the sensation of the need to void (Moheb et al., 2019).

Additionally, the subjects reaching end-of-life and those receiving hospice services may have played a role as a potential confounder in the overall results due to the decreased engagement and utilization of the MSSE intervention as functional abilities and performance skills would have been declining during the study. In Chapter II, for instance, hospice care patients were found to have a significant increase in the number of reported falls as more patients were
added to hospice services when compared to non-hospice care patients during the 12-month analysis. These hospice patients appear as outliers and represent their own sub-population in this study. In a cohort study of 754 community-living older adults analyzing functional trajectories one year prior to receiving hospice services, it was found that functional decline does begin in the year prior to receiving hospice care but that decline is particularly poor among patients with neurodegenerative diseases such as Alzheimer’s, Parkinson’s, and Huntington’s disease (Stabenau et al., 2015).

Other factors potentially affecting validity in this study may be that the care staff documentation could have differed between staff members due to understanding of behaviors associated with older adults diagnosed with dementia. Similarly, the consistency of documentation of resident falls and psychotropic medication administration is not certain. Finally, staff satisfaction and perception of the effectiveness of the MSSE as a nonpharmacological intervention are unknown and could have been a confounder throughout this study.

**Implications**

These studies were designed to address the gaps in literature by examining the use of an open-floorplan MSSE as a nonpharmacological treatment for older adults diagnosed with dementia to reduce BPSD, decrease the use of psychotropic medications, reduce falls, and improve employee outcomes. The findings of these studies provide further support that an MSSE can improve patient outcomes, not only in a secluded treatment room but also in a common-space setting that allows an ambulatory resident to utilize the space freely. With more research in these areas, the impact of an open-floorplan MSSE may add to the evidence needed to install an MSSE in all memory care settings to improve quality of care for residents diagnosed with dementia. Further
studies exploring the financial and clinical impact of this MSSE could provide the support required for health insurers to reimburse for the use of this treatment design.

As institutions explore the potential of installing an MSSE within their care setting, operational decision makers will find that the benefits of this treatment option do show promise in the improvement of behaviors and mood in ambulatory residents diagnosed with dementia without the need to increase the number of employees. On the other hand, residents unable to ambulate voluntarily to the MSSE treatment space may not utilize the space without the help of care staff and will not achieve the same results without the added cost of one-to-one supervision of employees. The design of the MSSE may vary greatly based on the layout of a memory care unit and could be costly for an institution to retro-fit a common-area MSSE design if the current space is not easily accessible by residents. Contrasting, the MSSE sensory equipment can vary based on the type of equipment the institution wishes to use making this treatment space customizable and achievable if expense plays a significant role in the decision to install this MSSE design. Additionally, the open-floorplan MSSE may show great benefit as an intervention within facilities of fewer resources such that the costs of the MSSE installation may be outweighed by the savings in employee turnover, pharmaceutical costs, and the expenses incurred following fall-related injuries. In a study exploring disparities in quality of patient care among African-American, Hispanic, and White Medicare beneficiaries diagnosed with dementia, findings reveal that White patients versus underrepresented populations are not receiving comparable quality of care and financial resources are fewer in minority-serving institutions (Rivera-Hernandez, Kumar, Epstein-Lubow, & Thomas, 2019). Additional implications of future studies may arise with differing subject populations, types of dementia in the population, functional level of the subjects, size of the MSSE, sensory equipment used in the MSSE, ease of use for staff or capabilities of
automation of the sensory equipment within the room, and number and type of psychotropic medications administered to the subject group. When operational decision makers are exploring the potential for installation of an open-floorplan MSSE within their facility, it is important to bring in interdisciplinary teams that specialize in the treatment, care, design, and evidence-based research that enhances the use and effectiveness of nonpharmacological treatments such as the MSSE for older adults with dementia.

**Future Research**

The use of an open-floorplan MSSE requires future exploration to build upon the evidence-based research needed to support the recommendation to implement these designs into memory care facilities. We recommend future studies to examine the differences in impact the intervention would have on residents of an MCAL not receiving end-of-life treatment versus those who are receiving services such as hospice and palliative care. Further research should explore the amount of time each resident spends in the MSSE space and how length of time, time of day, and frequency of use is related to clinical outcomes. Other questions to be answered include examining biometric responses from individuals utilizing the MSSE space. Additionally, future studies of the open-floorplan MSSE would need to be analyzed in differing locations of underrepresented populations and within varying socioeconomic status groups with respect to the patient population and the employee population to determine impact across groups. Future studies would further add to the evidence-based research by determining the most impactful multisensory equipment utilized for the MSSE to produce the best outcomes for the resident.
References


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Appendix A

Human Subjects Institutional Review Board Letter of Approval 2017
Date: October 3, 2017

To: Kieran Fogarty, Principal Investigator
    Dana Prince, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 17-09-10

This letter will confirm that your research project titled "Using Multisensory Stimulation Environment (MSSE) in a Memory Care Assisted Living with Reduced Personnel Interaction: A Pilot Study" has been approved under the exempt category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may only be conducted exactly in the form it was approved. You must seek specific board approval for any changes in this project (e.g., you must request a post approval change to enroll subjects beyond the number stated in your application under "Number of subjects you want to complete the study"). Failure to obtain approval for changes will result in a protocol deviation. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

Reapproval of the project is required if it extends beyond the termination date stated below.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: October 2, 2018