Investigating the Impact of Multi-Sensory Environments on Behavior for People with Dementia

Lesa Lorusso, PhD, Healthcare Director of Research & Innovation, Gresham Smith
Nam-Kyu Park, PhD, Associate Professor, University of Florida, Department of Interior Design
Sheila Bosch, PhD, Assistant Professor, University of Florida, Department of Interior Design
Ronald Shorr, MD, MS, Department of Veterans Affairs, Director VA NF SG GRECC
I. Magaly Freytes, PhD, Research Health Scientist, Department of Veterans Affairs
Sherry Ahrentzen, PhD, Professor, University of Florida, Shimberg Center for Housing Studies
Maureen Conroy, PhD, Professor, University of Florida

This research was produced in collaboration with:
University of Florida, College of Design, Construction & Planning
Department of Veteran’s Affairs, Geriatric Research Education and Clinical Center
Introduction

Dementia is a pervasive cognitive condition that impacts a significant portion of the global population.

People estimated to be living with dementia
(Prince et al., 2013)

2010 | 35.6 million
2050 | 115.4 million

Percentage of dementia-care service needs centered on behavior problems
(Borson et al., 2014)

25%
1 in 9 Americans over 65 have Alzheimer’s Disease

Approximately 5.4 million Americans of all ages have Alzheimer’s Disease

14% of people aged 71+ in the US are diagnosed with some form of dementia

(Alzheimer’s Association, 2016)  
(Plassman, et al., 2007)
What’s wrong with medication?

Drug-based interventions are costly and dangerous.

(Gitlin, Kales, & Lyketsos, 2012)

Powerful, black box, psychotropic medications are not FDA-approved and yet prescribed as sedatives for dementia.

(Tinklenberg et al., 2007; Borson et al., 2013)

The Omnibus Budget Reconciliation Act of 1987 requires non-pharmacological management interventions exhausted prior to chemical restraint.

(Shorr, Fought, Ray, 1994; Baker et al., 2006)
Model of Imbalances in Sensoristasis (Kovach, 2000)

PROBLEM BEHAVIORS:

Life altering levels of agitation, aggression, anger, anxiety and disengagement due to cognitive decline.

And the inability to adapt to stressful environmental experiences.

(Cipriani, Vedovello, Nuti, & Di Fiorino, 2011; Baker, Hanley, & Mathews, 2006; Sloane et al., 2004; Cohen-Mansfield & Parpura-Gill, 2007; Padilla, 2011; Dubois et al., 2016; Kales, Gitlin & Lyketsos, 2015)
Impact of the Built Environment on Behavior:

The built environment, [the architectural environment people inhabit], is capable of modifying the role of human genes and impacting cognition.  

(Academy of Neuroscience for Architecture, 2015; Zeisel, 2006)

An enriched environment can contribute up to a 25% increase in the number of brain connections.  

(Peterson, O’Donnell, Wicklund, Pigozzi, & Mau, 2010)

Research has demonstrated advantages of the built environment for people living with dementia.  

(Calkins, 1988; Elliot, 2013; Gesine Marquardt et al., 2014; Tilly & Reed, 2008; Zeisel et al., 2003; Zeisel, Hyde, & Levkoff, 1994)
Multi-Sensory Environments

Flexible, purposefully designed environments to help people reach sensory equilibrium.

Use visual, auditory, tactile and olfactory stimuli: Ergonomic vibro-acoustic furniture, bubble tubes, color-changing LED lighting solutions, music, fiber optics and aromatherapy.

Shown to have positive impact on behavior for people with dementia.

(Yao & Algase, 2006; Baker et al., 2001; Collier, McPherson, Ellis-Hill, Staal, & Bucks, 2010; Brennan, Su, & Horowitz, 2006)
Statement of the Problem

Practitioners support the impact of MSE on behavior for people with dementia, but more evidence-based research is needed.

The Department of Veterans Affairs (VA) has implemented MSE therapy for Veterans with dementia since 2010 and it remains to be systematically evaluated.

AIMS AND OBJECTIVES:

This research focuses on an evaluation of Multisensory Environments for dementia behavioral therapy at VA Community Living Centers *(VA equivalent to assisted living facilities)*.
Research Questions and Overall Study Framework

**Study 1**
Impact of Multi-Sensory Environments on Behavior for People with Dementia: A Systematic Literature Review

**RQ1**
What evidence exists in the literature regarding the effectiveness of MSE and variations in its application?

**Study 2**
Understanding Barriers to Uptake of Multi-Sensory Environments for Veterans with Dementia

**RQ2**
What are the barriers to uptake and Staff perceptions regarding the effectiveness of MSE at VA CLCs?

**Study 3**
Effects of MSE Intervention on Behavior in Assisted Bathing for Veterans with Dementia

**RQ3**
What is the impact of MSE on behavior during assisted bathing for Veterans with dementia?
Study 1

Impact of Multi-Sensory Environments on Behavior for People with Dementia: A Systematic Literature Review

RQ1

What evidence exists in the literature regarding the effectiveness of MSE and variations in its application?
Systematic Literature Review

In order to inform Studies 2 and 3, a thorough investigation of the literature regarding Multisensory Environmental interventions for dementia designed with consistent elements was needed.

1,226 articles were included, published during 1990 to 2015 reporting empirical studies of MSE interventions for problem behaviors including furniture, fixtures, and equipment to provide visual, auditory, tactile, and olfactory stimulation.

PRISMA and PICO frameworks were used.

---

**PRISMA and PICO Diagram**

<table>
<thead>
<tr>
<th>P</th>
<th>Patient, Population or Problem</th>
<th>Dementia</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Intervention</td>
<td>Multisensory Environments</td>
</tr>
<tr>
<td>C</td>
<td>Comparison of Intervention (if appropriate)</td>
<td>NA</td>
</tr>
<tr>
<td>O</td>
<td>Outcome to Measure or Achieve</td>
<td>Patient Behavior</td>
</tr>
</tbody>
</table>
Findings

MSE interventions have a positive impact on mood and behavior (e.g., independence in ADLs), reduce BPSD, and therefore likely improve quality of life for patients and caregivers.

Study designs (pre-post) and comparisons (activity based) were not person-centered and therefore ill-fitted for dementia focused investigation.

Single-Case Design methods should be used in future studies, based on a person-centered approach integrating participant preference.

Of the 12 studies that met the final inclusion criteria, non studied MSE within the bathing environment, where most problem behaviors occur.
Study 2

Understanding Barriers to Uptake of Multi-Sensory Environments for Veterans with Dementia

RQ2

What are the barriers to uptake and staff perceptions regarding the effectiveness of MSE at VA Community Living Centers?
Barriers to MSE Uptake & Staff Perceptions

The VA has provided Multisensory Environments to Veterans with Dementia at Community Living Centers since 2010 through Flaghouse.

The first VA-funded Multisensory Environment was in Wilkes Barre, PA and over 53 now exist in both dedicated room and mobile cart applications across the US and Puerto Rico.
Questionnaire Instrument

The questionnaire included 15 items (5 demographic and 10 related to barriers and effectiveness of MSE).

Consisted of 4 sections, described below:

**Section 1**
Designed to gather operational data of the facility and understand level of involvement with the Multi-Sensory Environment (MSE). Likert Scale, multiple choice.

**Section 2**
Designed to gather clinical data regarding the use of MSE at each facility. Likert Scale, multiple choice.

**Section 3**
Designed to ascertain barriers to MSE uptake, Veteran preferences and staff perceptions of MSE effectiveness. Likert Scale, multiple choice, open-ended.

**Section 4**
Designed to allow participants to provide comments regarding lessons learned and suggestions for other facilities interested in MSE. Open-ended.
Conceptual Framework & RQI Procedure

Conceptual diagram illustrating the diffusion of Multisensory Environments as an innovation throughout the VA since 2010

(Rogers, 1962)
Conceptual Framework & RQI Procedure

Primary & Secondary Coders develop domain consensus

Phase 1
Develop Domains
Week 1

Phase 2
Initial Coding Process
Weeks 2-4

Phase 3
Small Team Coding
Weeks 5-6

22 Total Interviews
Findings

VA Staff Rating Effectiveness of MSE Equipment

Veteran’s Most Preferred Sensory Items
### Findings

<table>
<thead>
<tr>
<th>Aim</th>
<th>Theme</th>
<th>Subtheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Inadequate Training</td>
<td>Not enough training overall</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inconsistent new staff training and cross-training</td>
</tr>
<tr>
<td></td>
<td>Lack of Staff Engagement with MSE</td>
<td>Lack of training explaining the purpose of MSE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High turnover prevents staff MSE engagement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lack of MSE knowledge negatively impacts perceived value</td>
</tr>
<tr>
<td></td>
<td>Lack of Clear MSE Maintenance Plan</td>
<td>Staff don’t want the added responsibility of MSE</td>
</tr>
<tr>
<td></td>
<td>Inadequate Accessibility to the MSE</td>
<td>Access barriers of room size, proximity and keys</td>
</tr>
<tr>
<td>A2</td>
<td>Importance of Communicating Applications,</td>
<td>Need to communicate behavioral applications</td>
</tr>
<tr>
<td></td>
<td>Methods and Preferences</td>
<td>Need to communicate successful documentation methods</td>
</tr>
<tr>
<td></td>
<td>Key Role of Design of the MSE</td>
<td>Importance of incorporating Veteran preferences</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Importance of a dedicated room</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Importance of a room large enough for a variety of applications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Importance of MSE interior design elements</td>
</tr>
<tr>
<td></td>
<td>Importance of an MSE Champion</td>
<td>Champion influences consistency in MSE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ownership of MSE programmatic elements</td>
</tr>
<tr>
<td></td>
<td>Positive Effects of MSE</td>
<td>MSE impacting positive behavior change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSE impact positive engagement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSE provide a calming effect</td>
</tr>
<tr>
<td></td>
<td>Unintended Negative Effects of MSE</td>
<td>Applications in addition to dementia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use it carefully for Veterans with PTSD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSE difficult for some patients to understand</td>
</tr>
</tbody>
</table>

A1= Barriers to Uptake of MSE at the VA for Veterans with Dementia
A2= Staff perceptions of MSE effectiveness at the VA for Veterans with Dementia
Study 3

Effects of MSE Intervention on Behavior in Assisted Bathing for Veterans with Dementia

RQ3

What is the impact of MSE on behavior during assisted bathing for Veterans with dementia?
MSE Bathing Study

MSE Bathing Study

Nursing home residents with dementia need who need help with bathing

(Baker, Hanley & Mathews, 2006; Sloane et al., 2004)

Problem behaviors occur during bath time and often last long after the bath.

(Baker, Hanley & Mathews, 2006; Sloane et al., 2004)
For the data analysis, anonymous personas and pseudonyms were assigned to each of the four Veteran participants as shown above.
Research Design

Experimental Field Study using Single Case Research Design (SCRD) Following the (A-B) multiple baseline across participants approach to investigate the impact of MSE on aggression and agitation during assisted bathing.

By design, if all three baselines change after the intervention is implemented, the results can be credited directly to the intervention. There is no need for a withdrawal period.

(Coffee, 2011; Kazdin, 2011)
Study Design

Operational behavioral definitions for people with dementia were defined as physical aggression, verbal aggression, attempted physical aggression, agitation, emotional symptoms, and engagement.

Operational definitions were adapted from the Care Recipient Behavior Assessment tool (CAREBA), which was used in the Bathing Without a Battle literature (Sloane et al., 2004).
Setting and MSE Intervention

Snoezelen Showering Guidelines:

Follow steps below before bringing the Veteran into the room

**Step 1**
Plug in light box at right of door. Flip black power switch on, then hold down red button for 6 seconds to power on. Point light at curtain.

**Step 2**
Plug in the Snoezelen Cart

**Step 3**
Plug in the aroma therapy diffuser

**Step 4**
Make sure the color wheel projector located on top of the Snoezelen cart is pointed at the shower area

**Step 5**
Turn on the music at Snoezelen cart. Bring in Veteran. Begin recording, proceed with shower. Turn off camera when finished. Call Medical Media to get the camera.
Setting and MSE Intervention

The location for the study was the bathing room and Multisensory equipment including a mobile cart with a bubble tube, LED color changing lights, LED fiber optic spray, music, colorful wall projections and aroma therapy.
The research team worked with program developers at Vanderbilt University to create a customized, touch screen application to code the behaviors. Baseline and intervention sessions were recorded and the frequency and duration of target behaviors observed was coded using the software. Two researchers calculated inter-rater reliability of 80% of coded behaviors.

### Observational Instrument

<table>
<thead>
<tr>
<th>File</th>
<th>Preferences</th>
<th>Timer</th>
<th>Physical Aggression</th>
<th>Other Emotion</th>
<th>Other Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Verbal Aggression</td>
<td>Happy</td>
<td>Engaged</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Attempted Physical</td>
<td>Sad</td>
<td>Disengaged</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Agitation</td>
<td>Angry</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Anxious</td>
<td></td>
</tr>
</tbody>
</table>
Participants

**Pat**
Female
Baseline Sessions: 3
Intervention Sessions: 4

**AI**
Male
Baseline Sessions: 5
Intervention Sessions: 12

**Bob**
Male
Baseline Sessions: 9
Intervention Sessions: 8

**Kyle**
Male
Baseline Sessions: 7
Intervention Sessions: 3
Results

Total percentage duration of positive behaviors
Results

Total percentage duration of problem behaviors
Summary of Findings

On average, positive behaviors increased and negative behaviors decreased for all participants in the MSE.

At the VA, dedicated MSE rooms were preferred by staff respondents over mobile carts.

Training, staff engagement, a clear maintenance plan and access to the MSE were critical barriers to uptake.

Veterans seemed to favor the bubble tubes, aromatherapy and solar wall projector which staff also perceived as being the most effective in reducing problem behavior.

MSE within the bathing environment may reduce problem behaviors and increase positive behaviors.

Incorporating sensory preference seems to contribute to the impact of the environment.
Implications for Practice

Medical care staff can use these findings to improve MSE uptake by implementing policies and organizational procedures that reduce barriers to uptake.

Healthcare design teams may help support better behavioral outcomes through incorporating sensory elements within the environments where problem behaviors are known to occur, like bathing rooms.

Families may assist their loved ones with dementia at home to improve quality of life through the use of multisensory environments within the home setting.

MSE may be broadly applicable to other cognitive impaired populations.
Implications for Future Research

Create a framework or guideline for MSE application at the VA that documents a step-by-step process for implementing MSE effectively.

Investigation of additional behavioral data recorded at the VA sites who participated in the interview-based study looking for insights.

Replicate interview study using an online format.

Follow up with VA staff participants of the interview study to validate findings and inquire deeper from questions that arose from first round of interviews.

Replicate the bathing study and or conduct the study at a non-VA site and or with participants who have other cognitive impairments.

Study impact of an MSE with greater customization and sensory preference incorporation.

Develop tools including an observational assessment and a sensory preference assessment.