Applying Stress Recovery Theory: Outdoor Intervention for Dementia Agitation Reduction in Memory Care Homes

Amelie Guinee

Department of Honors, Colorado State University

Department of Human Dimension of Natural Resources, Colorado State University

Institute for the Built Environment

Fall 2024

Abstract

This paper serves as a part-literature review, part-explorative analysis on methods, specifically outdoor exposure, that may reduce agitation experienced by dementia patients. Agitation is reportedly the most common symptom displayed by dementia patients in memory care facilities, which puts significant strain on both the patients and caregivers. Yet, interventions to control and reduce this agitation are still relatively unknown. I hope to compare heart rate variability (HRV) metrics on healthy older adults who have spent time in nature, virtual reality, and indoor conditions to determine whether time spent outdoors promotes stress recovery, a paradigm known as the Stress Recovery Theory. I will use these findings on healthy older adults to inform likely patterns in dementia patients living in memory homes. I specifically hope to understand if implementing certain outdoor-driven shifts in spatial, environmental, or technological designs in memory care facilities may further promote reduced agitation.

Keywords: heart rate variability, memory care, outdoors, dementia, agitation, stress

Applying Stress Recovery Theory: Outdoor Intervention for Dementia Agitation Reduction in Memory Care Homes

Introduction

For dementia patients undergoing care in memory facilities, quality of life is, in part, dependent upon the facility's specific guidelines, restrictions, and levels of access. Memory care facilities that are larger-- defined as those that are housed with at least 26 beds-- are prone to more documented care violations, and tend to have decreased bandwidth for individualized and mental health-oriented care (Trinkoff et al., 2019). These facilities' formulaic approaches to care that value efficiency over quality may increase daily stressors for the residents (Volicer, 2005). These stressors, known as Behavioral and Psychological Symptoms in Dementia (BPSD), increase agitation, aggression, and apathy in patients (Cloak & Al Khalili, 2022). Agitation, which can manifest as restlessness, disruptive and repetitive vocalizations, and misplaced hostility, is the most common neuropsychological symptom of dementia in memory facilities (Bunn & Handley, 2019). It is a financially costly manifestation that also fosters decreased quality of life for both the residents and caregivers, and yet, few to no effective strategies outside of pharmacological interventions are known.

Outside of populations with memory impairments, a vast body of literature indicates that nature, or time spent outdoors, is a reliable and effective method for reducing stress. This principle is known as the Stress Recovery Theory (SRT) (Ulrich, 1984). Bratman et al. (2012) outline the many ways that nature has been cited to improve well-being-- including increased cognitive abilities like memory and attention, increased affect and emotional fulfillment, and, notably, decreased stress. Nature's impact on stress recovery can be measured through three metrics of heart rate variability (HRV)-- RMSSD, RSA, and heart rate (HR). Consistent with past findings, I

expect time spent in nature to increase RSA, increase RMSSD, and decrease HR. Liu et al. (2022) investigated the use of HRV as a novel biomarker for recognizing agitation in Alzheimer's and dementia patients, and they found that their research supported this potential. Consequently, it is reasonable to conclude that discussing stress as virtually synonymous with agitation in the context of the SRT is empirically supported.

I thus propose that increasing outdoor exposure for dementia patients in memory care facilities will limit episodes of BPSD, thereby reducing agitation and similar manifestations. I specifically propose utilizing the built environment or smart technology to facilitate this outdoor exposure, contributing to increased quality of life for both patients and staff.

To connect to agitation reduction in populations with dementia, I will be analyzing data from a study conducted on younger and older adults, measuring cognition, heart rate, and affect in nature, virtual reality, and indoor environments (Johnson et al., 2023). My research is not intended to directly measure the impact of outdoor exposure on agitation reduction, given the leap in the population and location of interest from the source data. As such, none of these conclusions are intended to be generalizable or to infer causal relationships between variables. Instead, the purpose of this thesis is to provide a starting point for future dementia research and development surrounding the built environment.

Review of Literature

Behavioral Symptoms of Dementia in Memory Facilities

Dementia, a broad term for a group of neurodegenerative diseases characterized by the progressive decline of cognitive function, is often thought of as only a memory-loss disease (Cloak & Khalili, 2022). However, individuals with dementia experience a far wider range of decline and debilitation that impact their daily functioning. Behavioral and Psychological Symptoms of Dementia (BPSD) is a general term for the neuropsychological symptoms experienced by people with dementia-- including, but not limited to, hallucinations, depression, anxiety, and agitation. These symptoms can manifest as repetitive movements, sleep disturbances, verbal aggression, perceptual confusion, and emotional dysregulation. In memory care facilities specifically, agitation is the most common symptom of BPSD. Livingston et al. (2017) interviewed staff and residents of 86 memory homes to explore the relationship between agitation and care facilities. They reported that 45% of residents with moderate to severe dementia experience agitation, which is correlated with decreased quality of life. The authors also note that agitation is not mitigated by increased caregiver hours or "activities as currently provided" by the facilities, though they did not expand on what such activities entailed.

While the incidence of dementia continues to increase-- by 117% from 1990 to 2016-- it is important now, more than ever, to find interventions to effectively mitigate these symptoms (Livingston et al., 2017). Because agitation seems to be resistant to most treatment methods, it has not garnered much intervention-based attention outside of pharmacological consumption. Bunn & Handley (2019) also attribute this lack of intervention success to insufficient context and willingness to leverage innovative strategies from both research and staff perspectives. Nevertheless, finding alternative methods to reduce the prevalence and effect of agitation on

dementia patients can result in fewer instances of verbal and motor aggression, increasing quality of life for both the patients and caregivers in memory care settings.

Nature's Impact on Stress Recovery

Outside of memory care facilities and populations with dementia, access to nature and the outdoors is robustly correlated with increased stress recovery. In fact, time spent in nature has numerous effects on human well-being, including increased cognitive performance (working memory, impulse inhibition, directed attention, and concentration), positive affect, and self-esteem (Bratman et al., 2012). The phenomenon of nature decreasing stress, deemed the Stress Recovery Theory (SRT), suggests that the physiological activity of our sympathetic-- or stress-activated-- and parasympathetic-- or resting-- nervous systems are crucial to stress responses in nature (Scott et al., 2020). Nature's impact on stress recovery can be measured through three metrics of heart rate variability (HRV), which describes the balance between the body's sympathetic and parasympathetic states. The first metric is Respiratory Sinus Arrhythmia (RSA), a vagally-mediated parasympathetic marker of HRV; the second is the root mean square of successive differences in heartbeats (RMSSD), another vagally-mediated parasympathetic marker; the final is heart rate (HR), a sympathetic marker. Past literature suggests that time spent in nature facilitates a reduction in HR, as well as an increase in both RMSSD and RSA-- in other words, increasing parasympathetic activity over sympathetic.

Evidence for this relationship is robust. Cheng et al. (2021) found that nature exposure in a forest, called forest bathing, decreased heart rate, systolic blood pressure, and sympathetic activity by significant margins. Beute & de Kort (2014) reached similar conclusions, stating that nature improved HRV recovery and decreased HR. What is less explored, however, is if certain populations experience SRT differently than others-- including people with dementia.

Nature's Impact on Dementia Patients

Although limited, the research that has focused on nature's role in stress reduction for dementia patients suggests that access to the outdoors can alleviate symptoms of agitation, acting as a viable non-pharmacological intervention for BPSD. Whall et al. (1997) conducted a study on late-stage dementia patients and found that exposure to simulated outdoor settings significantly reduced both agitation and aggression. Their results indicated that the presence of bird sounds, natural light, and greenery had an immediate calming effect on patients, decreasing their stress levels. This study emphasizes the potential for natural environments to serve as passive therapeutic interventions for agitation in late-stage dementia. Interestingly, rather than bringing the experimental condition to an outdoor space, the researchers merely simulated a natural environment by constructing a shower room that mimicked the sensory experiences of nature, suggesting that alternatives to outdoor environments intended to simulate nature may elicit the same stress-recovery benefits associated with real-world nature.

Another way that facilities can incorporate simulated natural environments is through virtual reality (VR). Reynolds et al. (2018) investigated the impact of VR nature experiences on anxiety and agitation in dementia patients. Their study found that this simulated VR exposure significantly reduced both agitation and anxiety, reinforcing the stress and agitation-reducing effects of immersive nature in simulation environments, which could hold important implications for dementia patients if the progression of their disease precludes them from easily accessing nature. Moreover, Whear et al. (2014) conducted a literature review examining the physical and mental states of dementia patients after access to the outdoors. They concluded that outdoor environments promoted increased mood and decreased agitation. Gardens, in particular, were spaces where dementia patients could experience a sense of peacefulness and freedom, which, in

term, reduced their agitation. The authors also reported that because of the residents' decreased aggressive and disruptive behaviors, they were able to foster stronger relationships with their caregivers, in turn reducing caregiver burden. All of these studies suggest that the SRT through outdoor exposure, even in alternative and unconventional settings, may apply to dementia patients. However, studies working this with population are limited, and more research should be done to explore this link.

Built Environment in Memory Facilities for BPSD Reduction

In order to facilitate agitation reduction in dementia patients, more accessible means to nature is an imperative consideration for memory facilities. Outside of residents' potential inability to access nature because of health or mobility conditions, these facilities can have numerous design flaws that further limit the ease and accessibility of outdoor exposure. Such limitations can include their location in urban settings, clinical interior architecture that discourages doors and windows, and a lack of dedicated outdoor spaces designed specifically for safe and comfortable patient use. Consequently, exploring ways to leverage the built environment by implementing changes in spatial and environmental design-- in conjunction with VR or otherwise simulated nature exposure-- can improve outdoor access necessary to promote this agitation reduction.

The built environment is defined as the physical structures and spaces designed for occupancy and everyday use, including architecture, landscaping, and interior design. In memory care settings, the built environment can play a critical role in facilitating access to outdoor spaces. Duggan et al. (2008) reinforce the idea that dementia patients often face barriers to outdoor exposure, highlighting their declining mobility and the inaccessibility of their living environments. However, they state that memory facilities can and should increase their intentionality with

building dementia-friendly environments, including green spaces, areas for gardening, and enclosed, internal courtyards with central access for residents.

One promising avenue is the creation of dementia-friendly gardens or courtyards within memory care facilities. Ferdous (2019) emphasizes that spatial design that incorporates nature can bolster positive affect among dementia patients, which can, in turn, reduce agitation. Internal courtyards provide a safe and easily-accessible area where residents can interact with nature without leaving the facility's boundaries, and gardens can provide a safe and low-effort activity to foster a sense of purpose among the residents while simultaneously incorporating access to nature. These spaces are proven to promote stress recovery, improve mood, decrease stress levels, and reduce agitation (Motealleh et al., 2019). Moreover, Noone and Jenkins (2017) explore the addition of community gardens. They found that gardening offers a tactile, low-intensity manner of nature engagement for dementia patients. These gardens not only allow residents to spend time in nature, but also provide them with a sense of purpose. And for those unable to actively participate in gardening, simply existing in these green spaces has also been shown to reduce agitation.

When leveraging spatial and sensory interventions to integrate nature into the everyday lives of dementia patients, memory facilities should strive to tailor this environmental planning to the specific needs of the residents, meeting them at their personal abilities and desires. Van Vracem et al. (2015) discuss how such personalized interventions can significantly reduce agitation by offering more calming, sensory-stimulating experiences. But ultimately, whether through technological tools like the use of VR to simulate nature, or through more direct outdoor interventions like internal courtyards and gardening, the built environment can be an essential tool in managing BPSD, and specifically reducing agitation.

Caregiver Capacity

In memory care facilities, the burden placed on caregivers is substantial. As caregiver capacity depletes, many caregivers working full-time in these facilities will experience increased physical and emotional strain (Volicer, 2005). These burdens are often exacerbated by amplified BPSD. But similar to how literature supports nature's role in decreasing agitation for residents in memory care settings, outdoor exposure can also help reduce the negative impacts of caregiver burden. Indirectly, decreased agitation among dementia patients can reduce the frequency and intensity of intervention required by caregivers, leading to a less stressful and more manageable work environment. Directly, Traynor et al. (2013) suggest that time spent outdoors improves mental well-being and reduces stress among caregivers. Implementing the aforementioned outdoor environments that are also accessible to caregivers, or promoting outdoor activities involving both caregivers and residents, can foster a healthier care environment and improve the quality of care and atmosphere of facilities because of this reduced caregiver strain.

Conclusion

Ultimately, finding non-pharmacological interventions to reduce BPSD symptoms, specifically agitation, in individuals with dementia living in care facilities is an important step to improving quality of life for both residents and caregivers in these memory homes. Research suggests that, in line with the SRT, access to nature and the outdoors is a promising avenue to promote parasympathetic activation and thus decrease stress and agitation. Leveraging the built environment through spatial and environmental design shifts, as well as technology like VR, may provide easy and accessible access to these spaces.

Methods

I sought to further explore the role of the SRT in older adults living with dementia, drawing data from specific sections of the study by Johnson et al. (2023) titled *Aging Naturally: Understanding How Spending Time in Nature Influences Older Adults' Executive Functioning, Heart Rate Variability, and Affect*. The original study investigated how real-world and VR nature impact executive functioning, affect, and HRV in healthy younger and older adults. Participants (N = 61) were randomly assigned to one of three conditions: real-world nature (RWN), virtual reality nature (VRN), or an indoor control condition, with each environmental exposure lasting twenty minutes.

For the present thesis, I focused exclusively on heart rate data from older adults, aged 55+ (n = 27), omitting data from younger adults. After processing ECG data with AcqKnowledge software, I conducted a series of linear mixed-effects models in RStudio to analyze within-subject changes in RMSSD, RSA, and HR values before and after environmental exposure. I hypothesized that, compared to the indoor control condition, time spent in nature and VR would more substantially increase RSA, increase RMSSD, and decrease HR. Within this stress recovery paradigm, I hypothesized that nature would impact the aforementioned trend of these markers more than VR.

Results

The results indicated no statistically significant changes in any of the physiological metrics from the pre- to post-conditions across the entire sample, non-differentiated by condition. RSA showed a non-significant increase from a mean of 8.38 to of 8.67 (p = 0.223); RMSSD increased marginally from 42.82 to 43.04 (p = 0.960); HR decreased slightly, from a mean of 61.31 to 60.85

BPM ($p = 0.629$). As such, the results suggest that, in aggregate, the environmental manipulations did not significantly impact HRV measures for older adults.

Examining the interaction effects by condition (indoor control, nature, and VR) using Satterthwaite's method to account for sample variance, no significant differences emerged either. For RSA, the difference in pre- to post-conditions between the indoor control and nature environments was non-significant ($p = 0.419$), as was the difference between the indoor and VR conditions ($p = 0.775$). For RMSSD, pre- to post-changes between indoor and nature were similarly non-significant ($p = 0.490$), as were differences between indoor and VR ($p = 0.450$). For HR, differences between indoor and nature conditions were non-significant ($p = 0.805$), as well as between indoor and VR ($p = 0.277$).

Directionally, RSA increased from pre- to post-conditions in both the lab and VR environments but decreased in nature. RMSSD increased in both nature and VR conditions but decreased in the lab. HR decreased in both lab and nature conditions, while it increased slightly in the VR condition. Despite these trends, none of the observed differences were statistically significant, indicating that exposure to real-world nature, virtual reality nature, and indoor control environments did not significantly alter HRV metrics for older adults in this study.

Discussion

Ultimately, my findings did not support my hypotheses that for older adults, time spent in nature should increase RSA, increase RMSSD, and decrease HR. These results conflict with a substantial body of literature suggesting that exposure to natural environments does, in fact, play a crucial role in stress recovery, as per the SRT. While I expected to observe these HRV patterns from pre- to post-conditions as indicators of autonomic nervous system activation and deactivation, the results instead showed non-significant changes across conditions. Specifically,

RSA showed a slight, non-significant increase in both lab and VR conditions and a decrease in the nature condition, the opposite of my hypothesis; RMSSD increased slightly in both nature and VR conditions and decreased in the lab condition, in alignment with my predictions; and HR decreased marginally in both lab and nature but increased slightly in the VR condition, which only partially supported my hypothesis. These findings indicate that, despite past work suggesting otherwise, the environmental manipulations did not significantly impact HRV measures among older adults, and that, specifically, real-world and virtual reality nature both did not facilitate significant decreases in sympathetic HRV measures.

There are numerous potential explanations for these results. While the literature suggests a net positive correlation between nature and stress recovery, pockets of it remain mixed and unexplored, and we are still learning so much about the complex mechanisms behind this paradigm (Bixler & Floyd, 1997). Moreover, the younger adult sample analyzed separately in the composite study demonstrated significant changes of stress recovery. This disparity between younger and older adults may suggest age-specific responses to nature-based interventions or modulators that should be explored further.

The study design also had several limitations that may have been instrumental in shaping the observed trends. A large oversight was the absence of a stress task prior to the environmental manipulations, intended to induce physiological and cognitive stress. Without initially inducing stress, the categorical measurement of stress recovery may have been hindered, since participants likely entered the “stress recovery” phase without an elevated level of physiological stress, potentially rendering the pre- and post-conditions as equals. Additionally, when I removed younger adults from the dataset and divided participants across the three environmental conditions, sample sizes were substantially reduced (n = 7 for nature, n = 12 for indoor, and n = 8 for VR). This

reduction decreased the statistical power of the analyses, thereby elevating the threshold for significance.

Outside of the study design and in application of my broader thesis, it is worth considering whether HRV alone is the most suitable measure for agitation reduction, especially for individuals with dementia. Although some studies have treated HRV change as synonymous with agitation, the comparison is not direct, and may impact analysis integrity (Bratman et al., 2012). Moreover, applying the results of a sample of healthy older adults to dementia patients is not a valid comparison, limiting generalizability and causality. Therefore, while this study's data provided a valuable starting point, I am not confident that it provided enough to offer conclusive evidence that nature exposure alone can impact agitation among dementia patients in memory care settings, underscoring the need for future studies with tailored designs and alternative BPSD measures, such as Restless Leg Syndrome (Lee et al., 2014).

Implications for this research lie in design alterations to memory care facilities. While more studies are needed to substantiate nature's impact on agitation reduction, existing literature around nature and the SRT could provide a starting point for the design changes these facilities could explore. Memory homes could integrate outdoor exposure by leveraging the built environment, building internal courtyards, accessible gardens, or spaces with larger windows that bring in natural light. When physical design changes are impractical due to financial, spatial, or locational constraints, VR nature could serve as an accessible alternative. If all of these implementations help to reduce BPSD and other psychological symptoms associated with dementia, their enactment will drastically improve the quality of life for both patients and caregivers, leading to more positive outcomes in memory care homes.

References

Beute, F., & de Kort, Y. A. W. (2014). Natural resistance: Exposure to nature and self-regulation, mood, and physiology after ego-depletion. *Journal of Environmental Psychology*, *40*, 167–178. https://doi.org/10.1016/j.jenvp.2014.06.004.

Bixler, R. D., & Floyd, M. F. (1997). Nature is scary, disgusting, and uncomfortable. *Environment and Behavior, 29*(4), 443-467. https://doi.org/10.1177/001391659702900401.

Bratman, G. N., Hamilton, J. P., & Daily, G. C. (2012). The impacts of nature experience on human cognitive function and Mental Health. *Annals of the New York Academy of Sciences*, *1249*(1), 118–136. https://doi.org/10.1111/j.1749-6632.2011.06400.x.

Bunn, F., & Handley, M. (2019). Reducing agitation in care home residents with dementia. *The Lancet Psychiatry*, *6*(4), 274–275. https://doi.org/10.1016/s2215-0366(19)30080-x.

Cheng, X., Liu, J., Liu, H., & Lu, S. (2021). A systematic review of evidence of additional health benefits from Forest Exposure. *Landscape and Urban Planning*, *212*, 104123. https://doi.org/10.1016/j.landurbplan.2021.104123.

Cloak, N., & Al Khalili, Y. (2022). Behavioral and Psychological Symptoms in Dementia. In StatPearls. StatPearls Publishing.

Connell, B. R., Sanford, J. A., & Lewis, D. (2007). Therapeutic effects of an outdoor activity program on nursing home residents with dementia. *Journal of Housing For the Elderly*, *21*(3–4), 194–209. https://doi.org/10.1300/j081v21n03_10.

Duggan, S., Blackman, T., Martyr, A., & Van Schaik, P. (2008). The impact of early dementia on outdoor life. *Dementia*, *7*(2), 191–204. https://doi.org/10.1177/1471301208091158.

Ferdous, F. (2019). Positive social interaction by Spatial Design: A systematic review of

empirical literature in memory care facilities for people experiencing dementia. *Journal of Aging and Health*, *32*(9), 949–961. https://doi.org/10.1177/0898264319870090.

Lee, D., Heo, S. H., Yoon, S.-S., Chang, D.-I., Lee, S., Rhee, H.-Y., Ku, B. D., & Park, K.-C. (2014). Sleep disturbances and predictive factors in caregivers of patients with mild cognitive impairment and dementia. *Journal of Clinical Neurology*, *10*(4), 304. https://doi.org/10.3988/jcn.2014.10.4.304.

Liu, K. Y., Whitsel, E. A., Heiss, G., Palta, P., Reeves, S. J., Lin, F. V., Roiser, J. P., & Howard, R. J. (2022). Heart rate variability: A novel biomarker for agitation propensity in Alzheimer's disease? *Alzheimer's & Dementia*, *18*(S7). https://doi.org/10.1002/alz.062172.

Livingston, G., Barber, J., Marston, L., Rapaport, P., Livingston, D., Cousins, S., … Cooper, C. (2017). Prevalence of and associations with agitation in residents with dementia living in care homes: MARQUE cross-sectional study. BJPsych Open, 3(4), 171–178. doi:10.1192/bjpo.bp.117.005181.

Mmako, N. J., Courtney-Pratt, H., & Marsh, P. (2020). Green spaces, dementia and a meaningful life in the community: A mixed studies review. *Health & Place*, *63*, 102344. https://doi.org/10.1016/j.healthplace.2020.102344.

Motealleh, P., Moyle, W., Jones, C., & Dupre, K. (2019). Creating a dementia-friendly environment through the use of outdoor natural landscape design intervention in long-term care facilities: A narrative review. *Health & Place*, *58*, 102148. https://doi.org/10.1016/j.healthplace.2019.102148.

Noone, S., & Jenkins, N. (2017). Digging for dementia: Exploring the experience of community gardening from the perspectives of people with dementia. *Aging & Mental Health*, *22*(7), 881–888. https://doi.org/10.1080/13607863.2017.1393793.

Reynolds, L., Rodiek, S., Lininger, M., & McCulley, M. A. (2018). Can a Virtual Nature Experience Reduce Anxiety and Agitation in People With Dementia? *Journal of Housing For the Elderly, 32*(2), 176–193. https://doi.org/10.1080/02763893.2018.1431583.

Scott, E. E., LoTemplio, S. B., McDonnell, A. S., McNay, G. D., Greenberg, K., McKinney, T., Uchino, B. N., & Strayer, D. L. (2020). The autonomic nervous system in its natural environment: Immersion in nature is associated with changes in heart rate and heart rate variability. *Psychophysiology*, *58*(4). https://doi.org/10.1111/psyp.13698.

Traynor, V., Fernandez, R., & Caldwell, K. (2013). The effects of spending time outdoors in daylight on the psychosocial wellbeing of older people and family carers: A comprehensive systematic review protocol. *JBI Database of Systematic Reviews and Implementation Reports*, *11*(9), 36–55. https://doi.org/10.11124/jbisrir-2013-1065.

Trinkoff, A. M., Lerner, N. M., Storr, C. L., Yoon, J. M., Yang, B. K., & Han, K. (2019). Nursing staff availability and other facility characteristics in relation to assisted living care deficiencies. *Journal of Nursing Regulation*, *10*(1), 21–27. https://doi.org/10.1016/s2155-8256(19)30079-1.

Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science, 224*(4647), 420–421. https://doi.org/10.1126/science.6143402.

Van Vracem, M., Spruytte, N., Declercq, A., & Van Audenhove, C. (2015). Agitation in dementia and the role of spatial and sensory interventions: Experiences of professional and family caregivers. *Scandinavian Journal of Caring Sciences*, *30*(2), 281–289. https://doi.org/10.1111/scs.12240.

Volicer, L. (2005). Caregiver burden in dementia care: Prevalence and health effects. *Current Psychosis & Therapeutics Reports 3*, 20–25. https://doi.org/10.1007/BF02629405.

Whall, A., Black, M., Groh, C., Yankou, D., Kupferschmid, B., Foster, N (1997). The effect of natural environments upon agitation and aggression in late stage dementia patients. *American Journal of Alzheimer's Disease, 12*(5). doi:10.1177/153331759701200506.

Whear, R., Coon, J. T., Bethel, A., Abbott, R., Stein, K., & Garside, R. (2014). What is the impact of using outdoor spaces such as gardens on the physical and mental well-being of those with dementia? A systematic review of quantitative and qualitative evidence. *Journal of the American Medical Directors Association*, *15*(10), 697–705. https://doi.org/10.1016/j.jamda.2014.05.013.

Figures

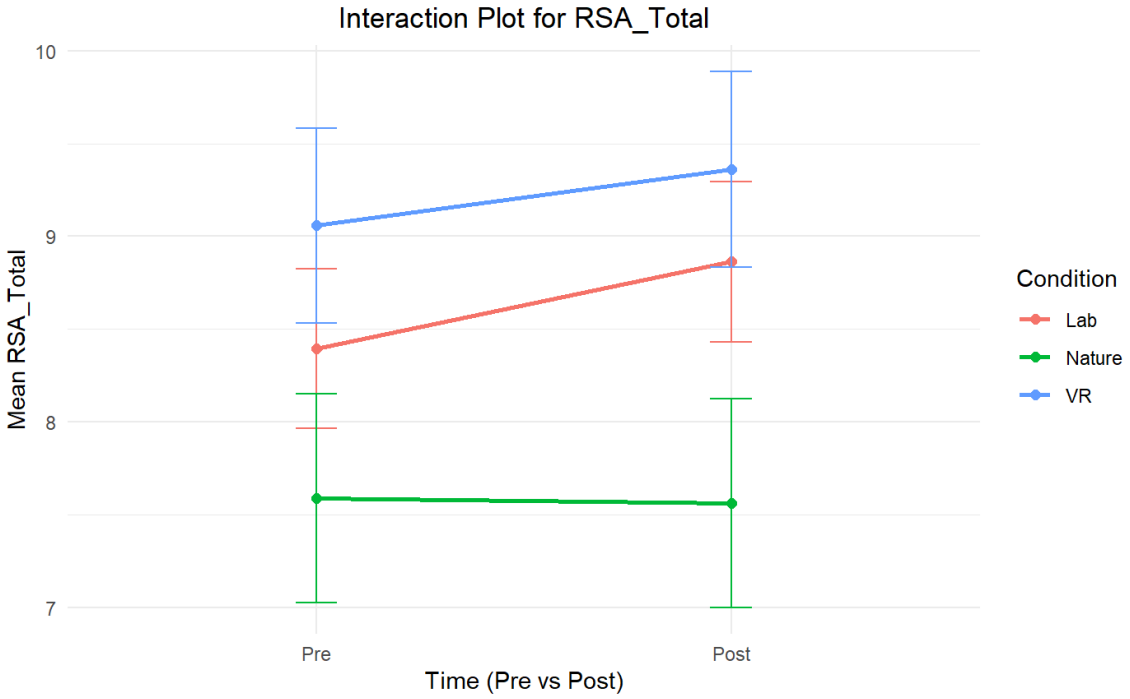

Figure 1

Change in RSA for Each Condition from Pre to Post

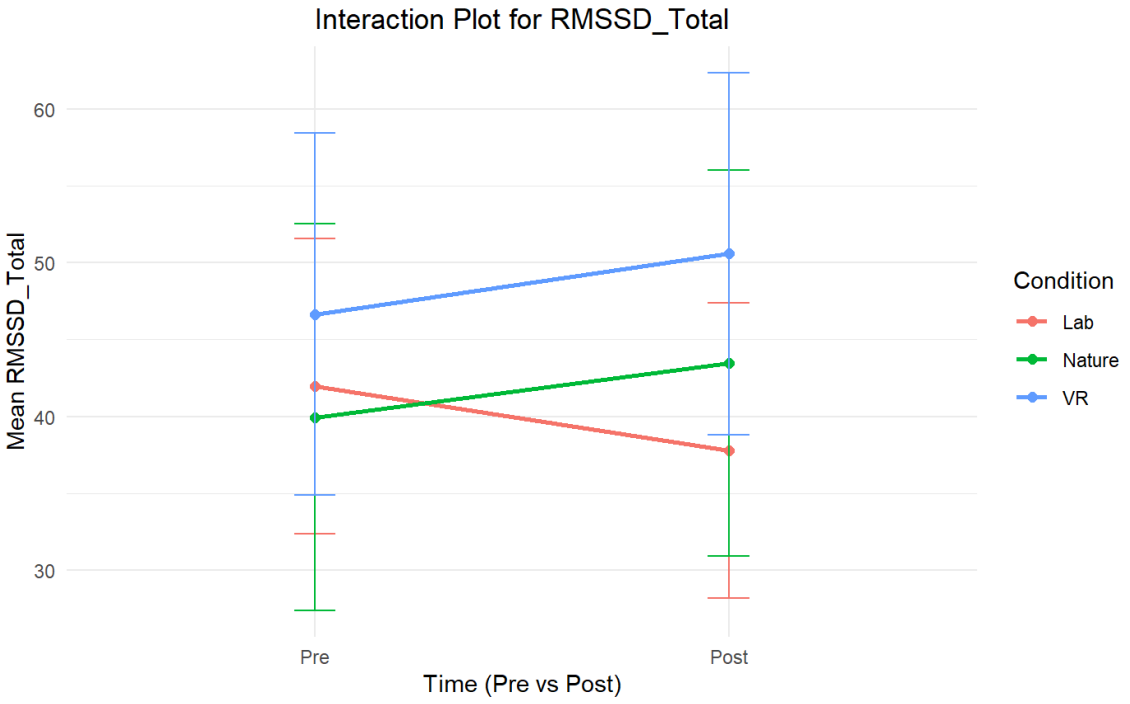

Figure 2

Change in RMSSD for Each Condition from Pre to Post

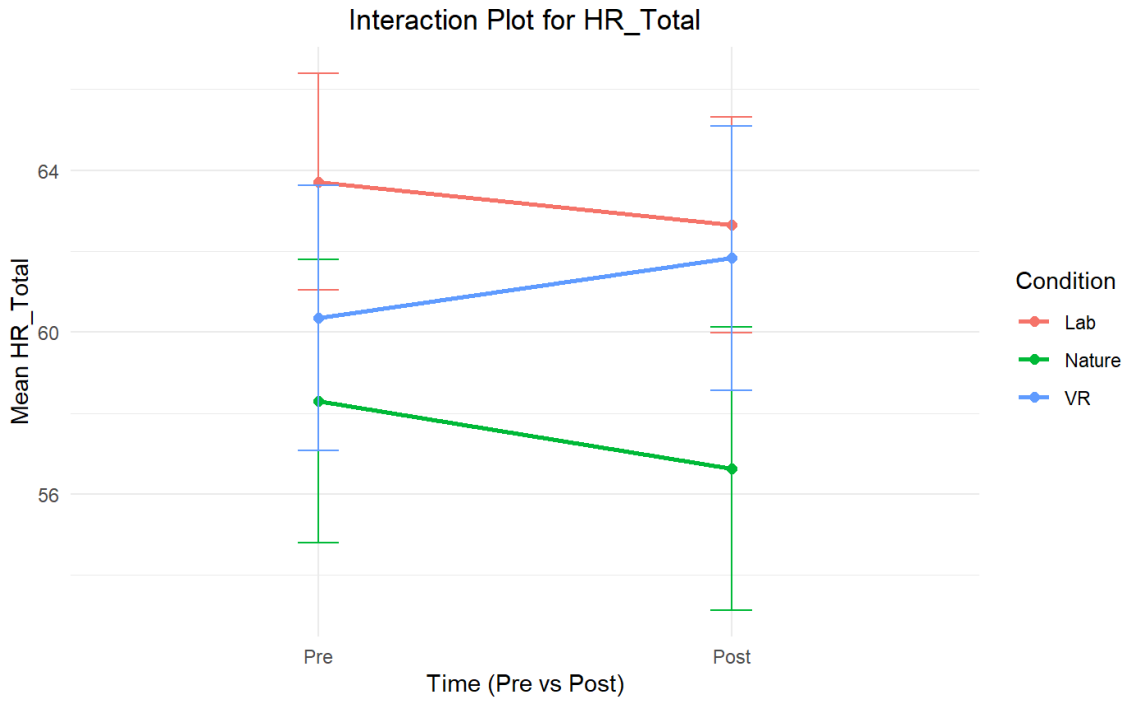

Figure 3

Change in Heart Rate for Each Condition from Pre to Post