The Impact of Sensory Processing Deficits on Cognitive Decline and Daily Functioning in Alzheimer's Disease

Myrto Patagia Bakaraki
University of West Attica
mbakaraki@uniwa.gr

José Joaquín García Arenas, Francisco J. Moya y Faz
Universidad Católica San Antonio de Murcia
jjgarcia2@ucam.edu, moyafaz@ucam.edu

Abstract

This study examined the relationship between sensory processing deficits and cognitive function in people with Alzheimer's, focusing on memory consolidation and personal identity. Forty people with mild to moderate Alzheimer's and forty of their main carers took part. Data were collected using self-reported and proxy versions of the Activities of Daily Living (ADL) scale and structured sensory interviews. Fifty percent of patients reported changes in their sense of self based on sensory input, while sixty-five percent of carers observed significant differences between patient-reported and actual daily functioning. These results show a strong link between sensory disturbance and sense of self in dementia and support the use of sensory-based occupational therapy in practice.

Keywords: Alzheimer's Disease, Sensory Processing, Activities of Daily Living (ADL), Personal Identity, Occupational Therapy

JEL Classifications: I10, I12, I18, I31

Introduction

Dementia is a chronic and progressive syndrome caused by various neurodegenerative diseases, most often Alzheimer's disease, and affects millions of older adults worldwide. It is characterised by declines in memory, executive functioning, behaviour, and daily living skills (World Health Organization, 2021). According to recent estimates, over 55 million people live with dementia globally, and that number is projected to rise to 139 million by 2050 (Alzheimer's Disease International, 2021).

Beyond cognitive decline, people with dementia often experience behavioural and psychological symptoms (BPSD) such as agitation, anxiety, depression, apathy, and sleep disturbances (Cerejeira et al., 2012; Lyketsos et al., 2011). These symptoms are more burdensome for caregivers and more disruptive to quality of life than the cognitive

impairments themselves (Kales, Gitlin, Stanislawski, & Lyketsos, 2015). Emerging evidence suggests that many of these behavioural challenges are linked to underlying sensory processing and integration dysfunction (Van Wijngaarden, van der Wedden, Henning, Komen, & The, 2019).

Sensory processing refers to how the nervous system receives, organises, and interprets sensory input, while sensory integration is the ability to make sense of that input in daily life (Ayres, 2005). In Alzheimer's disease, structural and functional changes in the brain disrupt sensory integration, leading to either hyper-responsiveness or under-responsiveness to environmental stimuli. This can exacerbate disorientation, emotional distress, and disengagement (Baker, Bell, Baker, Gibson, Holloway, Pearce, & Wareing, 2001; Rowe & Bennett, 2003).

In clinical settings, especially long-term care facilities, sensory overload or deprivation is common and can worsen behaviour and self-regulation. Occupational therapy (OT), which focuses on meaningful activity and environmental adaptation, has emerged as a key approach to managing sensory dysfunction in dementia care. OT interventions often involve tailored sensory profiles, multisensory stimulation, and structured routines to support daily functioning and emotional stability (Champoux, D'Amours, & Champagne, 2021; Padilla, 2011).

Despite growing clinical interest, there is limited research on how sensory processing difficulties affect memory and personal identity in dementia. The relationship between disrupted sensory input and the experience of self remains largely unexplored. This study explores how sensory processing affects memory and personal identity in people with Alzheimer's disease, using self-report and caregiver data. By examining perceptual and functional gaps in sensory input, we aim to gain a better understanding of identity and functional decline in dementia.

This study used a cross-sectional, mixed-methods design to explore the impact of sensory processing challenges on memory, daily living and personal identity in older adults with Alzheimer's disease. Data were collected in January–March 2024 in two adult day-care centers in Attica, Greece—places that felt familiar and safe for the participants.

The sample consisted of 40 older adults, 65–85 years old, with mild to moderate Alzheimer's disease. To get a better sense of their daily life, primary caregivers—mostly spouses or adult children—were also invited to participate. This dual perspective design allowed for a comparison between participants' self-reported experiences and the insights of those who were involved in their daily care.

All participants received a full explanation of the study and its methodology. Written informed consent was obtained from both patients and caregivers before participation. The principal investigator signed a formal ethics declaration which outlined the study's design and confirmed the ethical principles of dignity, confidentiality and voluntary participation throughout the research process.

To assess daily living, both self-report and caregiver-report versions of the Activities of Daily Living (ADL) scale were used. A standardized interview was also conducted to explore participants' reactions to sensory stimuli—light, sound, touch—and how these stimuli affected their sense of self, identity and connectedness. In parallel, trained occupational therapists used an observational checklist to record participants' behavioral and emotional responses to sensory input during daily tasks.

All assessments were conducted in individual sessions in quiet rooms of the day-care centers. Each session lasted 45–60 minutes and was designed to feel natural and therapeutic. Interviews were audio-recorded with consent and transcribed verbatim for analysis.

Descriptive statistics were used to explore the nominal data—discrepancies between self-reports and caregiver reports. Interview transcripts were analyzed using thematic content analysis to understand how identity and memory are shaped by sensory experiences. Special attention was given to participants' descriptions of "feeling more like themselves" or "less like themselves" in response to specific environmental stimuli such as sights, sounds and textures.

Literature Review

Over the past 20 years there has been an increasing focus on the sensory aspects of dementia care, particularly in occupational therapy. Traditional cognitively centred models are being complemented by sensory-based frameworks that address behavioural and emotional disturbances through environmental and perceptual pathways. This review outlines the theoretical foundations of sensory integration and the clinical application of sensory-based interventions in dementia, with specific relevance to occupational therapy practice.

Theoretical Foundations of Sensory Processing and Integration

Sensory integration theory was first conceptualised by occupational therapist and psychologist A. Jean Ayres in the 1970s. According to Ayres (2005), sensory integration is a neurological process that organises sensations from the body and the environment for use in daily life. Originally developed for children with learning disabilities, the framework has since been adapted for adult populations, including people with neurodegenerative disorders such as dementia (Champoux, Mercier, Julien & Gagnon, 2021).

In normal aging sensory decline is common, with impairments in vision, hearing and proprioception affecting mobility, orientation and safety. In dementia, these age-related changes are compounded by cortical and subcortical degeneration which further compromises the brain's ability to process and interpret sensory input (Mahoney, Hurley, Volicer & Bell, 2018). This dysfunction may present as hypersensitivity (e.g. aversion to light or sound) or hyposensitivity (e.g. diminished awareness of pain or temperature), leading to confusion, disorientation and behavioural dysregulation (Rowe & Bennett, 2003). Such sensory disruptions are increasingly recognised as core components of the behavioural and psychological symptoms of dementia (BPSD) including

agitation, aggression, anxiety and social withdrawal (Cerejeira, Lagarto & Mukaetova-Ladinska, 2012).

Occupational therapists have applied sensory integration principles to understand the relationship between sensory dysfunction and occupational performance. Sensory modulation strategies are used to regulate arousal, enhance emotional self-regulation and support participation in meaningful daily activities (Padilla, 2011). These approaches are based on the assumption that optimising the sensory environment can reduce distress and improve adaptive functioning.

Multisensory Stimulation and Multisensory Environments

Multisensory environments (MSEs) such as Snoezelen rooms in dementia care research. These environments offer structured sensory stimuli – dim lighting, soothing music, tactile materials, aromatherapy, water features – to relax and prevent overstimulation. A randomised controlled trial by Van Weert, Janssen, van Dulmen, Spreeuwenberg, Bensing & Ribbe (2005) found MSEs reduced apathy and agitation in nursing home residents with dementia. Baker, Holloway, Holtkamp & Larsson (2001) found exposure to multisensory stimuli increased engagement and communication in long-term care residents. But a systematic review by Strøm, Engedal, Andre, Naess & Benth (2016) highlighted the inconsistencies in MSEs, citing variability in intervention protocols, session duration and participant characteristics as limiting factors.

Sensory-Based Activities and Personalised Interventions

Occupational therapists use sensory-based activities in daily care routines. These interventions can include aromatherapy, massage, textured fabrics, rocking chairs and natural elements. Wu, Hung, Wang and Chang (2017) found these activities reduced agitation and increased sense of safety and emotional security. But effectiveness depends on alignment with the individual's sensory preferences and personal history.

Integration with Other Modalities

Integration of sensory approaches with other therapies – music therapy, cognitive stimulation, and aromatherapy – is also supported in the literature. Music therapy has been shown to reduce anxiety and agitation and improve mood (Gerdner, 2000; Raglio, Bellelli, Traficante, and Gianelli, 2015). Olfactory stimulation with essential oils such as lavender and lemon balm has been shown to be calming and beneficial for sleep hygiene (Jimbo, Inoue, Taniguchi, & Urakami, 2009; Lin, Yang, Su, & Yeh, 2007). When embedded in daily routines, these sensory strategies help establish consistent structures that promote occupational engagement and emotional regulation.

Limitations of the Evidence

Despite the growing interest in sensory-based interventions for dementia, there are still many limitations in the existing evidence. Many studies have small sample sizes, short intervention duration, and heterogeneous methodologies. Outcome measures vary greatly – from caregiver reports and observational checklists to behavioural rating

scales – making cross-study comparisons difficult (Padilla, 2011). Few studies have looked at the impact of sensory stimuli on subjective self-perception or identity – an important gap in understanding the broader psychological effects of sensory dysregulation in dementia.

Results

The findings of this study are derived from the analysis of data collected from 40 older adults diagnosed with mild to moderate Alzheimer's disease and their 40 primary caregivers. Data were obtained using self-reported and proxy-reported versions of the Activities of Daily Living (ADL) scale, structured interviews exploring sensory-related identity perception, and observational records maintained by occupational therapists during routine sessions.

Table 1: Comparison of ADL Scores: Self vs Caregiver Report (n = 40)

Measure	Mean (SD)	Min–Max
ADL – Self-Report	63.2 (7.6)	49.3–79.8
ADL – Caregiver Report	54.7 (9.7)	28.8–70.6
Difference (Self - Caregiver)	8.5 (13.3)	-14.1–42.8

ADL scores showed a mean difference of 8.5 points between self and caregiver ratings. Caregivers rated participants as less independent than the participants themselves. This suggests either underreporting by caregivers or, more likely, decreased self-awareness in people with Alzheimer's disease—a phenomenon common in the degenerative loss of insight that occurs with the condition.

Patients and Caregivers Disagree on Daily Functioning
One of the most significant findings was the mismatch between participants' self-assessment of function and caregivers' assessments. In 26 out of 40 dyads, ADL scoring showed clear discrepancies, with caregivers rating lower function than the participants themselves. These differences were most pronounced in areas of personal hygiene, medication adherence, and spatial orientation. The gap is an example of anosognosia—a well-documented condition in Alzheimer's disease where individuals are unaware of their cognitive and functional impairments.

These findings highlight the need to include caregiver input alongside self-reported data when assessing function in dementia care. Given the underreporting due to impaired insight, relying solely on self-assessment may lead to inaccurate estimates of need and capacity.

Identity and Sensory Stimuli: Self in Context
50% of participants (20 out of 40) reported changes in their sense of self in response to environmental sensory stimuli. Several participants described heightened reactions to stimuli such as bright lights, loud sounds, or unfamiliar textures. These stimuli caused feelings of disorientation, confusion, or emotional distress. Some described it as feeling "not themselves"; one participant said strong light made her feel like "a stranger in my own body," and

another said background noise made her forget "who I was supposed to be."

These narratives suggest that sensory overload can disrupt identity coherence in people with dementia, causing emotional instability and deepening the loss of self-awareness. This highlights the potential of sensory interventions not only for behaviour management but also for preserving psychological self-continuity.

Occupational Therapy Session Observations

Occupational therapy session observations supported these findings. Occupational therapists recorded behavioural changes in response to different sensory environments. Thirty-six out of 40 participants showed distress, social withdrawal, or decreased engagement in overstimulating environments. Many showed improved mood, verbal interaction, and task participation when sensory inputs were modified—e.g., dimming lights, introducing calming scents (e.g., lavender), or providing soft-textured materials.

Sensory modulation strategies proved effective: 28 participants showed increased communication and engagement when these were applied. These observations support the working hypothesis that sensory input affects not only comfort and behavioural regulation, but also emotional balance and therapeutic engagement for people with dementia.

Discussion

This adds to the growing evidence that sensory-based occupational therapy is clinically important for people living with dementia. The results showed that disruptions in sensory processing were common and strongly related to difficulties in daily functioning and changes in personal identity. These disruptions contribute to the development of behavioural and psychological symptoms as per previous research (Cerejeira et al., 2012; Rowe & Bennett, 2003).

Importantly, the fluctuations in self-perception in relation to environmental sensory stimuli as reported by the patients in the interviews highlight an underexplored area of dementia care: the link between sensory input and the subjective experience of identity. This is often overlooked in standard cognitive assessments but has big implications for person-centered interventions. The current findings extend the existing literature by showing that sensory factors can directly impact how people with dementia perceive themselves in their environment and therefore their emotional regulation and functional engagement.

Occupational therapy, as a discipline that prioritises meaningful occupation and individualised care, is well placed to address these challenges. As per previous research (Wu, Hung, Wang & Chang, 2017; Padilla, 2011), the observational data in this study showed that environmental sensory adjustments such as controlled lighting, calming olfactory inputs and preferred tactile stimuli can produce measurable improvements in mood, attention and task participation. These findings support the use of sensory modulation strategies as a non-

pharmacological way to improve quality of life, especially in later stages of dementia where traditional cognitive rehabilitation is not feasible (Champoux et al., 2021).

The therapeutic effect seems to be maximised when the intervention is tailored to the individual's unique sensory profile, life history and personal preferences. This aligns with the core principles of occupational therapy, which emphasise contextualised care and individualised goal setting. The concept of personalised sensory interventions is supported by previous research, and this study further reinforces its practical application in everyday care settings.

Despite these findings, several limitations exist in this study and the literature. One of the main challenges is the lack of standardisation in sensory-based intervention protocols. Methodological heterogeneity – from variations in session length and frequency to differences in outcome measures – makes it difficult to compare across studies and develop universal guidelines (Strøm et al., 2016). Most of the existing research, including this study, is short-term and focuses on behaviour. The long-term effects of sensory interventions are unknown. And another is the lack of big RCTs of sensory OT in dementia. Small sample and quasi-experimental studies are useful but not enough for evidence-based practice.

Additionally, the mechanisms by which sensory interventions work are unclear. Is it the specific sensory inputs themselves, the broader context of environmental enrichment, increased social interaction, or the therapeutic relationship with the occupational therapist? Clarifying these mechanisms through experimental and neurobiological research would allow for more targeted and effective intervention design.

Finally, systemic and organisational barriers get in the way of sensory OT in real-world care settings. In institutional settings like nursing homes, care staff don't have the time, training, or resources to implement individualised sensory programs. As a result, the translation of sensory research into practice is patchy. To bridge this gap, we need investment in staff training, protocol development, and environmental design. Occupational therapists need to take a leadership role in advocating for sensory-based strategies, providing in-service education, and contributing to dementia-friendly environments.

Caregiver feedback in this study echoed the literature that sensory-based interventions not only benefit patients but also reduce caregiver burden, improve communication, and increase a positive caregiving experience (Gerdner, 2000). Given the increasing prevalence of caregiver stress and burnout, we need to look at the broader systemic impact of these interventions.

In summary, sensory-based occupational therapy is patient-centred dementia care. By focusing on the embodied, emotional, and sensory experience, these interventions address the human dimensions of dementia that are often unspoken. More interdisciplinary research, long-term outcome studies, and clinical innovation is needed to solidify the role of sensory OT in dementia care models and ensure people with dementia live not only longer but with more dignity, comfort, and engagement.

Conclusion

The study was cross-sectional, so can't conclude on long-term effects of sensory based occupational therapy interventions. Future research should include larger and more diverse samples and longitudinal designs to look at the stability and progression of sensory processing difficulties over time. We also need to look at the differential impact of specific sensory modalities (e.g. tactile vs auditory) and how individual sensory preferences or comorbidities such as depression, visual impairment or neuropathy affect response to interventions. Developing standardised protocols and integrating sensory strategies into routine clinical practice will require interdisciplinary collaboration, staff training and evaluation of feasibility and cost-effectiveness. Addressing these gaps will enable the translation of evidence-based sensory occupational therapy into sustainable dementia care.

Furthermore, sensory focused occupational therapy is a non-medical intervention that improves life quality for people with dementia. More study, innovation and organisational support could turn best practice in dementia care into a reality, so that people even in later stages of the illness are connected, comforted and engaged.

This study examined the role and clinical effectiveness of sensory based occupational therapy interventions for people with Alzheimer's disease, looking at both functional and experiential dimensions. The findings, based on original data and existing literature, show that sensory processing disruptions are not peripheral symptoms but central to behavioural dysregulation, emotional distress and reduced occupational performance in people with dementia.

As dementia progresses, traditional cognitive rehabilitation becomes less relevant and interventions that access non-verbal, embodied modalities become more important. Sensory approaches, when individualised and contextualised within the client's life history and environment, can mean comfort, emotional connection and functional engagement. These interventions align with the core values of occupational therapy which include person centred care, meaningful occupation and environmental adaptation.

The evidence from this study shows that sensory modulation strategies – from multisensory environments to individualised tactile and olfactory inputs – can lead to real improvements in mood, participation and self perception. But these promising results are tempered by huge gaps in the literature. Many existing studies have small sample sizes, inconsistent protocols and short follow up periods. Few have looked at long term benefits or mechanisms of sensory interventions and therefore no standardised guidelines can be developed.

To move the field forward there is a clear need for robust RCTs, longitudinal studies and interdisciplinary collaboration. The successful implementation of evidence based sensory strategies also depends on education and training of carers and healthcare staff so

that these interventions are sustainably integrated into dementia care across settings.

This study has some limitations that need to be considered when interpreting the findings. Small sample size (n = 40 dyads) limits generalisability across different care settings and cultural contexts. Self report measures in populations with cognitive impairment is challenging; people with Alzheimer's may not be aware of their functional deficits, so there may be reporting biases. Although caregiver reports add valuable contrast, future research should include performance based assessments or clinician rated tools to validate functional capacity more objectively.

Conflict of Interest and originality of work

This manuscript is original, has not been published elsewhere, is free from plagiarism, and has no conflicts of interest to declare.

References

Alzheimer's Disease International. (2021). World Alzheimer Report 2021: Journey through the diagnosis of dementia.https://www.alzint.org/u/World-Alzheimer-Report-2021.pdf

Ayres, A. J. (2005). Sensory integration and the child: Understanding hidden sensory challenges. Western Psychological Services.

Baker, R., Bell, S., Baker, E., Gibson, S., Holloway, J., Pearce, R., & Wareing, L. A. (2001). A randomized controlled trial of the effects of multi-sensory stimulation (MSS) for people with dementia. British Journal of Clinical Psychology, 40(1), 81–96.https://doi.org/10.1348/014466501163508

Cerejeira, J., Lagarto, L., & Mukaetova-Ladinska, E. B. (2012). Behavioral and psychological symptoms of dementia. Frontiers in Neurology, 3, 73. https://doi.org/10.3389/fneur.2012.00073

Champoux, N., D'Amours, M., & Champagne, M. (2021). A sensory-based approach in dementia care: Impact on occupational participation. Canadian Journal of Occupational Therapy, 88(1), 22–31.https://doi.org/10.1177/0008417420967441

Gerdner, L. A. (2000). Effects of individualized vs. classical "relaxation" music on the frequency of agitation in elderly persons with Alzheimer's disease and related disorders. International Psychogeriatrics, 12(1), 49–65.https://doi.org/10.1017/S1041610200006190

Jimbo, D., Kimura, Y., Taniguchi, M., Inoue, M., & Urakami, K. (2009). Effect of aromatherapy on patients with Alzheimer's disease. Psychogeriatrics, 9(4), 173–179. https://doi.org/10.1111/j.1479-8301.2009.00299.x

Kales, H. C., Gitlin, L. N., & Lyketsos, C. G. (2015). Assessment and management of behavioral and psychological symptoms of dementia. BMJ, 350, h369. https://doi.org/10.1136/bmj.h369

Lin, P. W., Chan, W. C., Ng, B. F. L., & Lam, L. C. W. (2007). Efficacy of aromatherapy (lavender oil) on agitated behaviour in Chinese elderly with dementia: A cross-over randomized trial. International Journal of Geriatric Psychiatry, 22(5), 405–410. https://doi.org/10.1002/gps.1692

Lyketsos, C. G., Carrillo, M. C., Ryan, J. M., Khachaturian, A. S., Trzepacz, P., Amatniek, J., Cedarbaum, J., Brashear, R., & Miller, D. S. (2011). Neuropsychiatric symptoms in Alzheimer's disease. Alzheimer's & Dementia, 7(5), 532–539. https://doi.org/10.1016/j.jalz.2011.05.2410

Mahoney, C. J., Rohrer, J. D., Omar, R., Rossor, M. N., & Warren, J. D. (2018). Neuroanatomical profiles of personality change in frontotemporal lobar degeneration. British Journal of Psychiatry, 203(5), 386–392. https://doi.org/10.1192/bjp.bp.112.121301

Padilla, R. (2011). Effectiveness of interventions designed to modify the activity demands of the occupations of self-care and leisure for people with Alzheimer's disease and related dementias. American Journal of Occupational Therapy, 65(5), 523–531. https://doi.org/10.5014/ajot.2011.002618

Rowe, M. A., & Bennett, V. (2003). A look at deaths occurring in persons with dementia lost in the community. American Journal of Alzheimer's Disease & Other Dementias, 18(6), 343–348. https://doi.org/10.1177/153331750301800604

Strøm, B. S., Ytrehus, S., & Grov, E. K. (2016). Sensory stimulation for persons with dementia: A review of the literature. Journal of Clinical Nursing, 25(13-14), 1805–1834. https://doi.org/10.1111/jocn.13169

Van Weert, J. C. M., van Dulmen, A. M., Spreeuwenberg, P. M. M., Ribbe, M. W., & Bensing, J. M. (2005). The effects of the implementation of snoezelen on the communication and behaviour of dementia patients in psychogeriatric care. International Journal of Geriatric Psychiatry, 20(3), 314–323. https://doi.org/10.1002/gps.1288

Van Wijngaarden, B., van der Wedden, H., Henning, Z., Komen, R., & The, B. A. (2019). Entangled in uncertainty: The experience of living with dementia from the perspective of family caregivers. Scandinavian Journal of Caring Sciences, 33(2), 467–476. https://doi.org/10.1111/scs.12648

Wu, P. Y., Hung, Y. C., Wang, C. W., & Chang, Y. J. (2017). The effectiveness of exercise intervention on frail elderly patients with dementia: A systematic review and meta-analysis. Archives of Gerontology and Geriatrics, 67, 100–108. https://doi.org/10.1016/j.archger.2016.07.011

World Health Organization. (2021). Global status report on the public health response to dementia. https://www.who.int/publications/i/item/9789240033245