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CADTH RAPID RESPONSE REPORT:
SUMMARY WITH CRITICAL APPRAISAL

Sensory Rooms for Patients with Dementia in Long-Term Care: Clinical and Cost-Effectiveness, and Guidelines

Service Line:	Rapid Response Service
Version:	1.0
Publication Date:	July 6, 2018
Report Length:	33 Pages

CADTH

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Cite As: *Sensory rooms for patients with dementia in long-term care: Clinical and cost-effectiveness, and guidelines.* Ottawa: CADTH; 2018 Jul. (CADTH rapid response report: summary with critical appraisal).

Acknowledgments:

ISSN: 1922-8147 (online)

Abbreviations

AOTA	American Occupational Therapy Association
MSE	multisensory environment
MSSE	multisensory stimulation environment
NICE	National Institute of Health and Care Excellence
RCT	Randomized Controlled Trial

Context and Policy Issues

Dementia is a progressive disease and is associated with impairment of mental functions[1]. It is manifested as one or more of the following characteristics: memory loss, language impairment, disorientation, personality changes, behavioral changes, difficulties with daily activities, self-neglect, and psychiatric symptoms.[2-4] In 2016, it was estimated that approximately 46.8 million people worldwide were living with dementia and that by 2030 this number is estimated to increase to 74.7 million.[3] In Canada, it is estimated that more than 402,000 individuals have a diagnosis of dementia, two-thirds of whom are women.[5] Considering Canada's aging population, this number is expected to increase in the future.[5] Caring for an individual with dementia is associated with substantial burden for the care-giver and for the healthcare system.[6]

Options for managing dementia symptoms include pharmacological and non-pharmacological therapies. The pharmacological therapies have been shown to render moderate benefits in the short term and are associated with safety concerns.[1,4,7] A variety of non-pharmacological options are available, one of which is use of a multisensory stimulation environment (e.g., Snoezelen room). There is some suggestion that sensory stimulation improves mood and reduces behavioral problems.[8,9] In a Snoezelen room an array of equipment is available to provide auditory, visual, olfactory, and tactile stimulations to the patient in a controlled manner in a calm and comforting environment.[8,10] The associated costs for setting up a Snoezelen room could vary from $10,000 to $30,000 and could exceed further depending on the complexity and quantity of equipment used.[11] There remains uncertainty around the clinical effectiveness and cost-effectiveness of sensory rooms.

The purpose of this report is to review the clinical effectiveness and cost-effectiveness of sensory rooms for patients with dementia in long-term care. Additionally, this report aims to review the evidence-based guidelines regarding the use of sensory rooms for patients with dementia in long-term care. This report is an update and expansion of a previous CADTH report entitled "Sensory Rooms for Patients in Long-Term Care: Clinical and Cost-Effectiveness and Guidelines".[12]

Research Questions

1. What is the clinical effectiveness of sensory rooms for patients with dementia in long-term care?

2. What is the cost-effectiveness of sensory rooms for patients with dementia in long-term care?
3. What are the evidence-based guidelines regarding the use of sensory rooms for patients with dementia in long-term care?

Key Findings

Based on the evidence identified in this review, it is not possible to make a definitive conclusion regarding the effectiveness of sensory rooms compared to other treatment modalities for improving symptoms in individuals with dementia. Generally in the short term, there appeared to be some improvements with therapy using multisensory stimulation environment such as Snoezelen, however the improvements were not significantly different compared with other treatment modalities.

No study assessing the cost-effectiveness of sensory rooms for patients with dementia in long-term care was identified.

Two evidence-based guidelines recommended several non-pharmacological interventions for individuals with dementia, including multisensory stimulation environments.

Methods

Literature Search Methods

This report makes use of a literature search strategy developed for a previous CADTH report. For the current report, a limited literature search was conducted on key resources including PubMed, PsycINFO via Ovid, The Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit retrieval by study type. Where possible, retrieval was limited to the human population. Previous literature search was limited to documents published between January 1, 2006 and October 31, 2016. The search for the current report was designed to overlap with the previous, and was limited to English-language documents published between January 1, 2015 and June 6, 2018.

Selection Criteria and Methods

One reviewer screened citations and selected articles from the current literature search (January 1, 2015 and June 6, 2018). In the first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion. Also, the potentially relevant articles identified from the previous literature search (January 1, 2006 and October 31, 2016) for a previous CADTH report were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

Population	Patients with dementia living in long-term care facilities
Intervention	Sensory rooms or multi-sensory environments (e.g., Snoezelen Rooms)
Comparator	Standard care, one on one interventions

Outcomes	Q1: Clinical effectiveness (e.g., improved sensory modulation and integration; emotional regulation, cognitive function, quality of life), safety Q2: Cost-effectiveness Q3: Guidelines
Study Designs	Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials (RCTs), non-randomized studies, economic studies, and evidence-based guidelines

Exclusion Criteria

Articles were excluded if they did not meet the selection criteria outlined in Table 1, they were duplicate publications, or were published prior to 2006. Systematic reviews with studies included in selected systematic reviews were excluded. Primary studies included in selected systematic reviews were excluded. Studies that did not investigate a multi-sensory environment were excluded.

Critical Appraisal of Individual Studies

The included systematic reviews were critically appraised by one reviewer using AMSTAR 2,[13] randomized controlled trials and observational studies were critically appraised using the Downs and Black checklist,[14] and guidelines were assessed with the AGREE II instrument.[15] Summary scores were not calculated for the included studies; rather, a review of the strengths and limitations of each included study were described narratively.

Summary of Evidence

Quantity of Research Available

A total of 399 citations were identified. These comprised 384 citations identified from the current literature search and 15 citations taken from the previous CADTH report. Following screening of titles and abstracts, 367 citations were excluded and 32 potentially relevant reports were retrieved for full-text review. One potentially relevant publication was retrieved from the grey literature search. Of these 33 potentially relevant articles, 22 publications were excluded for various reasons, while 11 publications.[2,3,6-9,11,16-19] met the inclusion criteria and were included in this report. These comprise two systematic reviews,[3,16] three RCTs,[6,7,17] four non-randomized studies,[8,9,11,18] and two evidence-based guidelines.[2,19] No relevant cost-effectiveness studies were identified. Appendix 1 presents the PRISMA flowchart of the study selection.

Summary of Study Characteristics

Characteristics of the two systematic reviews,[3,16] three RCTs,[6,7,17] four non-randomizedstudies,[8,9,11,18] and two evidence-based guidelines.[2,19] are summarized below and details are available in Appendix 2, Tables 2 to 6.

Study Design

One systematic review[16] included 12 studies published between 2001 and 2014, from Canada, USA, and Europe, of which seven studies were RCTs and the remaining studies were of various designs (Appendix 2, Table 2). The second systematic review[3] had a broad objective and included various therapies, only studies relevant (i.e. assessing sensory rooms or multisensory environments) for our report were included. This systematic review[3]

included seven studies comprising five RCTs and two non-randomized studies, published between 2001 and 2011 from Australia, Canada, and Europe.

Three relevant RCTs[6,7,17] and four relevant non-randomized studies[8,9,11,18] were identified. All the four non-randomized studies were prospective studies and of these studies, two[9,18] were cross-over studies with the same patients being exposed to both experimental and comparator interventions. Due to the nature of the studies, blinding of patient and therapist were not possible.

Of the two included evidence-based guidelines,[2,19] one guideline[19] mentioned a systematic literature search and one guideline[2] did not explicitly mention it in the guideline document but the associated guidelines manual indicates requirement for a systematic literature search. For both guidelines, the guideline development group included content experts. One guideline[19] graded the recommendations and one guideline[2] did not present grading for the recommendations.

Country of Origin

One systematic review[16] was published from USA in 2018, and one systematic review[3] was published from Norway in 2016.

Of the three included RCTs[6,7,17], one RCT[17] was published in 2018, and two RCTs[6,7] were published in 2016; all were from Spain. Of the four observational studies,[8,9,11,18] two studies were published from Australia in 2011[9] and 2015,[11] and two studies were published from the USA in 2014[8] and 2017.[18]

One guideline[19] was published in 2017by the American Occupational Therapy Association (AOTA) in the USA, and one guideline[2] was published in 2006 by the National Institute for Healthcare Excellence (NICE) in the UK.

Patient Population

Both systematic reviews[3,16] included patients with dementia. In one systematic review,[16] the number of patients in the included studies varied between four and 36. The majority of the included patients were 65 years or older and were predominantly female patients. In the second systematic review[3] the number of patients in the included studies varied between 18 and 136 with majority of the studies having 30 or fewer patients; the age and sex of the patients were not reported.

In the three included RCTs[6,7,17] the patients had a diagnosis of severe or very severe dementia, the number of patients ranged between 21 and 32, mean age ranged between 85 years and 89 years, and the proportion of female participants ranged between 68% and 78%. In the four included observational studies,[8,9,11,18] the patients had a diagnosis of dementia; the mean age ranged from 88 years to 89 years in three studies,[8,9,18] and in the fourth study[11] the median ages were 81 years in the Snoezelen group, and 88 years in the non-Snoezelen group; the proportion of female participants varied between 69% and 75% in three studies[8,11,18], and sex was not reported in one study.[9]

For one guideline[19] the target population was adults with Alzheimer's disease and related major neurocognitive disorders; and for one guideline[2] the target population was individuals with dementia.

Interventions and Comparators

In one systematic review,[16] therapy with multisensory environment was compared with reminiscence therapy, activity therapy, care as usual, or no therapy or were pre- and post-studies. In the second systematic review,[3] Snoezelen therapy was compared with reminiscence therapy, gardening therapy, activity therapy, or care as usual. The duration of the sessions varied between 8 minutes and 40 minutes in one systematic review,[16] and varied between 16 minutes and 40 minutes in one systematic review.[3]

In two RCTs[6,17] multisensory stimulation environment (MSSE) therapy was compared with music therapy, and in one RCT[7] MSSE therapy was compared with activity therapy, or treatment as usual. In the included observational studies, MSSE therapy (Snoezelen therapy) was compared with garden therapy,[8,9] exercise therapy,[18] or common best practice (which was not defined).[11]

Both guidelines[2,19] reported on multisensory stimulation interventions, and one guideline[19] explicitly mentioned as an example, the use of Snoezelen.

Outcomes

In the systematic reviews, the outcomes assessed included mood,[3,16] behaviour,[3,16] agitation,[3,16] function,[3,16] cognition,[16] balance,[3] and well-being.[3] Available details of scales used to measure outcomes are presented in Appendix 2, Table 4.

In the RCTs,[6,7,17] the outcomes assessed included mood[6,7,17] behavior,[7,17] anxiety,[6] cognition,[6,7] and dementia status.[6] In the non-randomized studies,[8,9,11,18] the outcomes assessed included behavior,[8,9,11] and agitation.[18]

Several outcome measures were reported; however results were mostly described qualitatively. Effect size was reported as Cohen's d; d = 0.2 indicates small effect, d = 0.5 indicates medium effect, and d = 0.8 indicates large effect.[17] Effect size was reported as eta-squared (η^2) values; $\eta^2 = 0.02$ indicates small effect, $\eta^2 = 0.13$ indicates medium effect, and $\eta^2 = 0.26$ indicates large effect .[6] Details of outcome measures are presented in Appendix 2, Tables 2 to 4.

The two guidelines[2,19] presented recommendations regarding the use of multisensory stimulation interventions.

Summary of Critical Appraisal

Critical appraisal of the studies is summarized below and details are available in Appendix 3, Tables 7 to 9.

In both systematic reviews[3,16] the objective and inclusion criteria were stated; multiple databases were searched; selection of articles was described; and list of included studies was provided. Study characteristics were described in both systematic reviews,[3,16] but details were lacking in one systematic review.[3] In both systematic reviews it was unclear if publication bias had been explored, and no meta-analyses were done. In one systematic review[16] it was unclear if article selection and data extraction were done in duplicate, or if quality assessment of studies were conducted; and conflicts of interest were not mentioned. In the second systematic review,[3] article selection and quality assessment of the studies were done in duplicate and studies were judged to be generally of good quality; whether data extraction was done in duplicate was not explicitly mentioned.; there were no potential

conflicts of interest. Considering the limitations mentioned above, findings need to be interpreted with caution.

In the three RCTs,[6,7,17] the study objective, and inclusion and exclusion criteria were stated; patient characteristics, intervention and outcomes were described; and randomization was via a computer-based random number generator. In all three RCTs there was no blinding hence potential for detection bias cannot be ruled out. In the three RCTs the sample sizes were small (≤ 32). It was unclear if sample size calculations had been undertaken hence it was unclear if there was sufficient power to detect a difference between therapies. In all three RCTs it was mentioned that there were no conflicts of interest. Considering the small sample size and lack of blinding, findings need to be interpreted with caution.

In the non-randomized studies[8,9,11,18] the study objectives were stated; and patient characteristics, intervention and outcomes were described. Inclusion and exclusion criteria were stated in one study[18] and was not stated in three studies.[8,9,11] None of these studies were randomized. In two studies[9,18] the same group of patients were exposed to both the experimental and the comparator interventions hence patient characteristics were balanced, however it is unclear if the first intervention could have impacted the findings of the second intervention. In two studies[8,11] with lack of randomization, the potential for selection bias cannot be ruled out. In all four studies there was no blinding hence potential for detection bias cannot be ruled out. In the four studies[8,9,11,18] the sample sizes were small (≤ 36) and it was unclear if sample size calculations had been undertaken hence it was unclear if there was sufficient power to detect a difference between therapies. In three studies[8,11,18] it was mentioned that there were no conflicts of interest and in one study[9] conflicts of interest were not mentioned.

In both guidelines[2,19] the scope and purpose were clearly stated. In the NICE guideline[2] details of the methodology used was not described and the evidence on which the recommendations were based was not described. The recommendations were not graded. However the guideline[2] was developed based on their guideline development manual, according to which the guideline development group comprises experts in the area as well as lay persons, conflicts of interest of the members are declared and resolved, a systematic literature search is undertaken, the best available evidence is used, resource implications are considered, the guideline is externally reviewed and a policy of updating is in place. The AOTA guideline[19] was authored by occupational therapists who also held academic positions at the University. A systematic review was conducted, recommendations were graded, the guideline was reviewed by content experts, a consumer representative, and policy experts, and it was mentioned that the authors had no conflicts of interest. Cost analysis or review of published cost analysis was not conducted.

Summary of Findings

What is the clinical effectiveness of sensory rooms for patients with dementia in long-term care?

Findings are summarized below and details are available in Appendix 4, Table 10

The systematic review by Lorusso et al.[16] showed that multisensory environment (MSE) therapy had a positive impact with respect to behavior, mood, and daily activities. However, there were no significant between-group differences for MSE therapy compared with other one-to-one interventions. The duration of the treatment effect was mixed; three studies

showed that the benefits did not last significantly beyond the treatment sessions, and one study showed that the benefits lasted up to 12 weeks after treatment.

The systematic review by Strom et al.[3] examined a variety of sensory stimulations and a subgroup of included studies compared Snoezelen with various control therapies, the findings of which are presented here. Target outcomes varied among the included studies. Snoezelen therapy offered significantly greater improvement compared with normal living room activities therapy (1 study) or usual care (2 studies). No between group differences were found for therapy using Snoezelen compared with therapies based on activities (2 studies), reminiscence (1 study), and gardening (1 study).

The RCT by Maseda et al.[17] included older adults with severe dementia and compared MSSE therapy with individualized music therapy. In the short term (10 minutes following the intervention session), both therapies had positive effects on mood and behavior, and that for most items there were no significant differences between the two therapies. The RCT by Sanchez et al.[6] included older adults with severe dementia and compared MSSE therapy with individualized music therapy. This RCT showed that the MSSE therapy appeared to have better effects on anxiety symptoms and dementia severity compared to individualized music therapy. There was no significant difference between the groups with respect to agitation, and cognitive status. The second RCT by Sanchez et al.[7] included older adults with severe dementia and compared MSSE therapy, activity therapy, and control therapy (daily routine at the center). This RCT showed that the MSSE therapy, appeared to have better effects on neuropsychiatric symptoms and dementia severity, compared with activity therapy. There was no significant difference between the groups with respect to agitation, and cognitive status. The MSSE therapy appeared to have better effects on dementia severity compared with control therapy, however there appeared to be no significant between group difference, with respect to psychiatric symptoms.

The prospective study by Bauer et al.[11] involved older adults with dementia and compared Snoezelen therapy with non-Snoezelen therapy (common best practice). Statistically significant improvements in behavior (wandering and restlessness) were found for both groups; there was no statistically significant difference between the two groups. The prospective cross-over study by Berkheimer and Qian[18]involved older adults with dementia and compared Snoezelen therapy with exercise therapy. It showed that there was improvement in behavior (agitation) with both interventions and there was no statistically significant between group difference. The prospective study by Anderson et al.[9] involved older adults with severe dementia and compared Snoezelen sessions with garden sessions (same group exposed to both interventions). It showed that there were no significant differences between the interventions with respect to engagement. The prospective study by Goto et al.[8] involved older adults with dementia (majority with Alzheimer's disease) and compared the Snoezelen environment with a Japanese garden environment. It showed that there was a significantly higher score (indicating better) with respect to staying awake with the garden environment than with Snoezelen environment. Also, there was more engagement, better mood, and greater verbal expression with the garden environment than with the Snoezelen environment, however significance levels for the differences were not reported.

What is the cost-effectiveness of sensory rooms for patients with dementia in long-term care?

No relevant study assessing the cost-effectiveness of sensory rooms for patients with dementia in long-term care was identified.

What are *the evidence-based guidelines regarding the use of sensory rooms for patients with dementia in long-term care?*

Findings are summarized below and details are available in Appendix 5, Table 11

The AOTA guideline[19] recommends several environment-based interventions to improve behavior and perception, and to reduce falls in adults with Alzheimer's disease and related major neurocognitive disorders; and multisensory interventions (in the short-term) are included among these.

The NICE guideline,[2] recommends several non-pharmacological interventions for care of people with dementia, and multisensory stimulation was included among these. This guideline also mentions that as people respond differently to the different care modalities, individual response needs to be monitored and the care plan adopted accordingly.

Limitations

There are several limitations to this review.

There is some overlap in the studies included in the two selected systematic reviews, hence findings reported in the two systematic reviews are not entirely unique. (Appendix 6, Table 12).

There is likely overlap in patients in two RCTs.[6,17] Both RCTs were conducted in specialized dementia centers in Coruna, Spain; the patient characteristics appeared mostly similar; the intervention and the comparator were same; and there was overlap in the authorship; it was difficult to ascertain if the two RCTs were unique. Hence there is potential of duplication of the patient population in the two studies. Furthermore though the third RCT[7] had a greater number of patients than the two RCTs,[6,17] it was also conducted in specialized dementia centers in Coruna, Spain; the corresponding author was the same; and there was also some overlap in the authorship, hence there is potential of some overlap in the patient population in this RCT and the other two RCTs[6,17] There were variations in the therapies investigated hence comparison across studies was difficult. Sample sizes were small (majority ≤ 36), and power calculations were not provided, hence may not have the power to detect a difference between therapies.

The majority of the studies were on older adults (age ≥ 80 years), hence the generalizability of the findings to other age groups may not be appropriate.

For both guidelines we were unable to access the evidence on which the recommendations were based.

Conclusions and Implications for Decision or Policy Making

Eleven relevant publications comprising two systematic reviews,[3,16] three RCTs,[6,7,17] four non-randomized studies,[8,11,11,18] and two evidence-based guidelines.[2,19] were identified. No study assessing the cost-effectiveness of sensory rooms for patients with dementia in long-term care was identified.

Generally in the short term, there appeared to be some improvements with therapy using MSSE such as Snoezelen, however the improvements were not significantly different compared with other treatment modalities.

The two guidelines recommended several non-pharmacological interventions for individuals with dementia, and included among these were multisensory stimulations. As people respond differently to the different care modalities, individual response needs to be monitored and the care plan adopted accordingly.[2]

The findings need to be interpreted in the light of limitations mentioned. Based on the evidence identified in this review, it is not possible to make a definitive conclusion regarding the effectiveness of sensory rooms compared to other treatment modalities for improving symptoms in individuals with dementia. Large, well designed, and long term studies are would reduce uncertainty regarding whether or not therapy using sensory rooms offers greater improvements compared with other treatment modalities.

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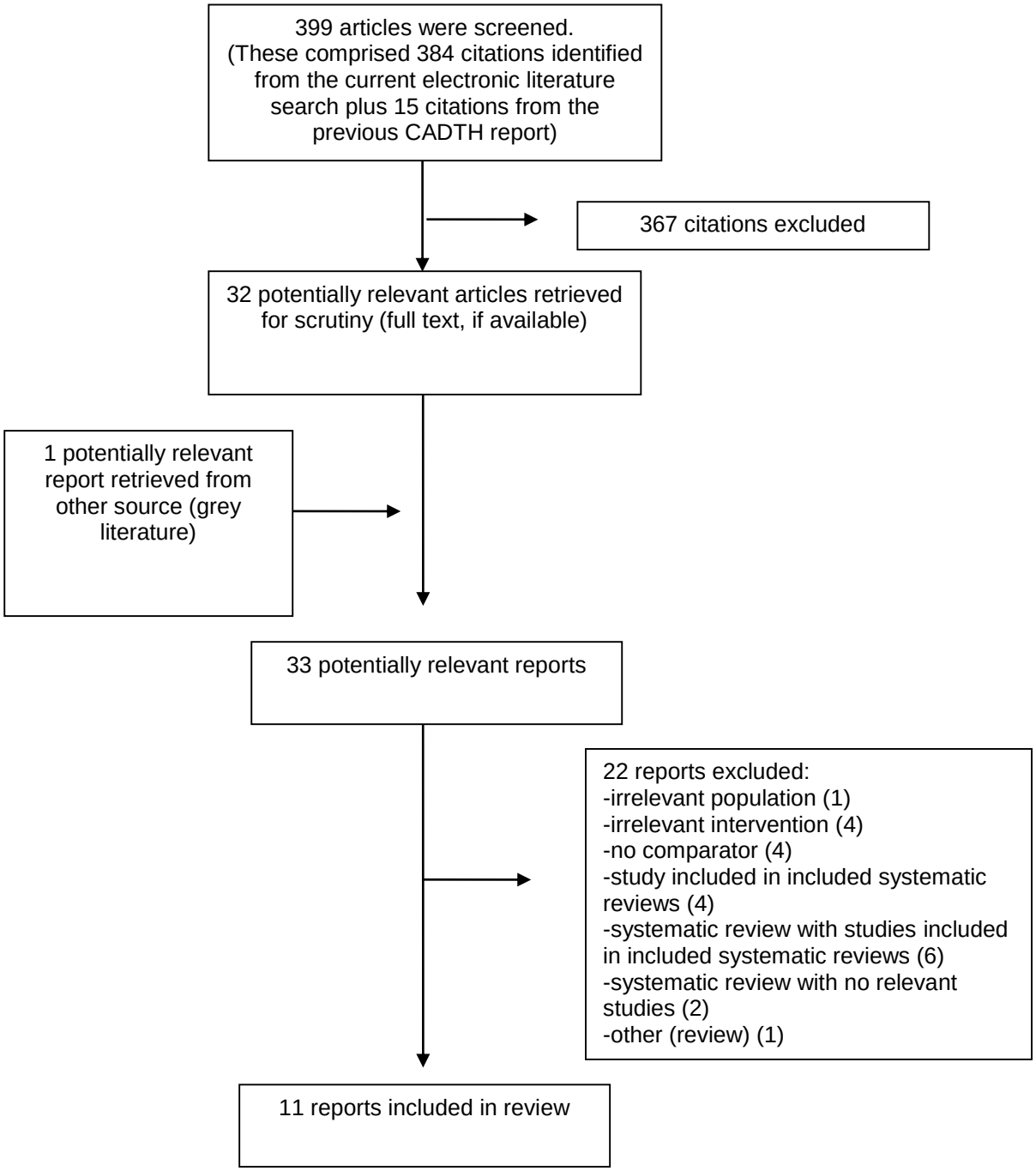
Appendix 1: Selection of Included Studies



Appendix 2: Characteristics of Included Publications

Table 2: Characteristics of Included Systematic Reviews

Author, Year, Country	Study Design	Population Characteristics	Comparison	Outcome
Lorusso,[16] 2018, USA	Systematic review It included 12 studies (7 RCTs, 1 within-group repeated measures design, 1 between-group mixed design,1 outcome-based quality improvement study, 1 single-case study, and 1 qualitative study) Studies were published between 2001 and 2014, and conducted in Canada, Europe or USA. Settings in the 12 included studies: skilled nursing facility (6), adult daycare center (4), mixed (nursing facility and daycare center) (1), and residential setting (1). Aim: To assess the use of multisensory environments as treatment for behavioral and psychological symptoms for dementia	Individuals diagnosed with dementia (moderate to severe) No. of individuals in the studies ranged between 4 and 36. Age: predominantly ≥ 65 years. % Female: Predominantly female.	MSE therapy (includes visual, auditory, tactile, and olfactory stimulation). The approach was a non-directive; staff followed the lead of the patient during the therapy sessions. The sensory stimuli were not sequential, hence requiring low cognitive demands on the patient. Comparators were reminiscence therapy (1), no therapy (1), care as usual (1), activity therapy (4); some were pre-post studies Sessions were between 8 minutes to 40 minutes. Number of sessions varied among the studies: 8 sessions (5 studies), sessions offered at regular intervals during the week (4 studies), offered intermittently (1 study), MSE therapy offered when BPSD occurred (2 studies).	Mood, behavior, agitation, cognition, and function levels. Outcome measures used include: CMAI, NPI-NH, CSDD, PBAR, DOS, CGI-I, ADL, BDP.
Strom,[3] 2016, Norway	Systematic review This systematic review had a broad focus and only studies on multisensory therapies which are of relevance for our reported are considered here. <u>Snoezelen:</u> There were 7 studies (5 RCTs, and 2 non-randomized study).	Individuals with dementia <u>Snoezelen:</u> No of individuals in the studies varied between 18 and 136, majority (5 studies) had ≤ 30 persons Age: NR % Female: NR	<u>Snoezelen therapy versus control</u> Control interventions comprised, reminiscence therapy (1), gardening (1), activities (3), or care as usual (1). One RCT compared biweekly Snoezelen with once a week Snoezelen Sessions varied between 16 to 40 minutes in	Mood, behavior, agitation, balance, well-being, function. Outcome measures used include: Interact during, Interact short, CGI-I, CMAI-I and others

Author, Year, Country	Study Design	Population Characteristics	Comparison	Outcome
	The studies were published between 2001 and 2011. Studies were conducted in Australia (1), Canada (2), the Netherlands (1), and the UK (3). Setting: Day center (1), nursing home (6)		duration, once or twice a week. The intervention period varied between 2 weeks to 18 months in 6 studies and was reported as 9 sessions in 1 study.	

ADL = activities of daily living; BPSD = behavioral and psychological symptoms of dementia; CGI-I = Clinical Global Improvement – Impression; CMAI = Cohen-Mansfield Agitation index; DOS = daily observation scale; MSE = multi-sensory environment; NPI-NH = Neuropsychiatric Inventory – Nursing Home; RCT = randomized controlled trial

Table 3: Characteristics of Included Clinical Studies

Author, Year, Country	Study Design	Population Characteristics	Comparison	Outcome
Randomized controlled trial				
Maseda,[17] 2018, Spain	RCT Patients were stratified according to their cognitive status and then randomized. Setting: In Coruña. Patients were recruited from a day care setting in a specialized dementia Gerntological Complex, and a nursing home for institutionalized individuals	Individuals diagnosed with dementia and with severe or very severe cognitive decline (GDS 6 to 7) N = 21 (10 in MSSE, 11 in Music) Age (mean ± SD (years): 88.9 ± 6.69 % Female: 71.4% Both groups were similar in terms of age, gender, marital status, and education level. (Patients were excluded if they had hearing impairment or other sensory disorders)	MSSE versus individualized music. The MSSE group had one-to-one multisensory sessions in a Snoezelen room where visual, auditory, tactile and olfactory stimulations were provided. The stimuli were non sequential (not requiring short term memory to link to previous events). The therapist used a non-directive, enabling approach. The individualized music group had music sessions in a quiet room Music was according to their musical preference. The therapist used a directive approach, selecting the music for each session; selection based on the participant's preferences and interests. For both groups, sessions were offered twice a week	Mood and behavior Outcome measures: Interact during, and Interact short (details presented in Table 4). Treatment duration: 12 weeks

Author, Year, Country	Study Design	Population Characteristics	Comparison	Outcome
			for 12 weeks. Each session was of 30 minutes duration unless the individual wanted to leave. Sessions were conducted by therapists in the area of psychology or occupational therapy, with training in the methodology used.	
Sanchez,[6] 2016, Spain	RCT Patients were stratified according to their cognitive status and then randomized. Setting: In Coruña. Specialized dementia elderly center.	Individuals diagnosed with dementia and with severe or very severe cognitive decline (GDS 6 to 7) N = 22 (11 in MSSE, 11 in music) Age (mean ± SD (years): 88.41 ± 6. 93 % Female: 68.2% Both groups were similar in terms of age, gender, marital status, and education level. (Patients were excluded if they had hearing impairment or other sensory disorders)	MSSE versus individualized music. The MSSE group had multisensory sessions in a Snoezelen room where visual, auditory, tactile and olfactory stimulations were provided. The stimuli were non sequential (not requiring short term memory to link to previous events). The therapist used a non-directive, enabling approach. The individualized music group had music sessions in a quiet room. Music was according to their musical preference. The therapist used a directive approach, selecting the music for each session; selection based on the participant's preferences and interests. For both groups, sessions were offered twice a week for 16 weeks. Each session was of 30 minutes duration, unless the individual wanted to leave. Sessions were conducted by therapists in the area of psychology or occupational therapy, with training in the methodology used.	Agitation. Mood, anxiety, cognitive status, dementia severity status. Outcome measures: CMAI, CSDD, RAID, SMMSE, BANS-S Treatment duration: 16 weeks
Sanchez,[7] 2016, Spain	RCT Patients were stratified according to their cognitive status and then	Individuals diagnosed with dementia and with severe or very severe cognitive decline (GDS 6	MSSE versus activity versus control The MSSE group had	Mood, behavior, and cognition Outcome measures:

Author, Year, Country	Study Design	Population Characteristics	Comparison	Outcome
	randomized. Setting: In Coruña. Specialized dementia elderly center.	to 7) N = 32 (11 in MSSE, 11 in activity, 10 in control) Age (mean ± SD (years): 85.4 ± 8.64 % Female: 78.1% There were no significant differences between the MSSE group and the activity group, or in the MSSE group and the control group with respect to age gender, marital status, or educational level. Significant differences were observed between the activity group and the control group with respect to gender, marital status, and educational level but no significant difference with respect to age. (Patients were excluded if they had hearing impairment or other sensory disorders)	multisensory sessions in a Snoezelen room where visual, auditory, tactile and olfactory stimulations were provided. The stimuli were non sequential (not requiring short term memory to link to previous events). The therapist used a non-directive, enabling approach. The activity group had one-to-one activity sessions with the therapist. The activities required intellectual and/or physical demand on the individual (e.g. looking at photographs, and playing games). The therapist used a directive approach The control group continued with the daily routines of the center such as cognitive stimulation group sessions, and training in daily activities	CMAI, CSDD, NPI SMMSE, BANS-S Treatment duration: 16 weeks
Non-randomized studies				
Anderson,[9] 2011, Australia	In this prospective study a within-subjects mixed methods design was used. Each individual had 3 sessions in the Snoezelen room and 3 sessions in the garden environment. Setting: In Canberra. A 176-bed residential care facility	Individuals with diagnosis of dementia (mean MMSE score = 5.7). They had moderate to severe cognitive impairment and exhibited challenging behaviors N = 12 (11 were from a locked dementia specific section, and 1 was from the low-level section of the facility) Age (mean ± SD (years): 89 ± 8.19 % Female: NR	Snoezelen room sessions versus Garden sessions. In the Snoezelen room, visual, auditory, tactile and olfactory stimulations were provided. Each individual was randomly assigned to a staff member, who conducted the 1-on-1 sessions. For each dyad, 3 sessions were conducted in the Snoezelen room and 3 sessions were conducted in the garden.	Behavior (engagement) Outcome measure: disturbed/disengaged; neutral; engaged; and very engaged. Observations were recorded before, during and after sessions. Sessions were conducted early in the project (weeks 1 & 2) and late in the project (weeks 4 & 5)

<table>
<tr><th>Author, Year, Country</th><th>Study Design</th><th>Population Characteristics</th><th>Comparison</th><th>Outcome</th></tr>
<tr>
<td>Bauer,[11] 2015, Australia</td>
<td>In this prospective study purposeful sampling was used to recruit individuals

Setting: two residential aged care facilities (RACFs); one of which had a dedicated Snoezelen room</td>
<td>Individuals with diagnosis of dementia; all had moderate to severe cognitive impairment.

N = 16 (9 Snoezelen [Snz] group, 7 non-Snoezelen [n-Snz] group)

Age:
<table>
<tr><th rowspan="2">Age in years</th><th colspan="2">Proportion in each group (%)</th></tr>
<tr><th>Snz</th><th>n-Snz</th></tr>
<tr><td>< 75</td><td>11.1</td><td>0</td></tr>
<tr><td>76 to 80</td><td>22.2</td><td>14.3</td></tr>
<tr><td>81 to 85</td><td>44.4</td><td>14.3</td></tr>
<tr><td>>85</td><td>22.2</td><td>71.4</td></tr>
</table>
% Female: 66.6 in Snz, 71.5% in n-Snz (in both groups [by calculation] = 68.7%)</td>
<td>Snoezelen versus non-Snoezelen (“common best practice”)

Details: NR

Individuals were assigned the interventions on a case by case basis by the care staff, based on clinical judgement and knowledge about the individual.</td>
<td>Behavior (wandering and restlessness)

Outcome measures: observation chart adapted from QEBAGS. A 4-point scale was used for eachnitem.

Observations were recorded at 4 time points: T0 = when the behavior occurred before any intervention, T1 = immediately following initiation of the intervention, T2 = 30 min after intervention, and T3 = 60 minute after intervention.

Follow-up: up to12 weeks</td>
</tr>
<tr>
<td>Berkheimer,[18] 2017, USA</td>
<td>This was a prospective cross-over study

Setting: Dementia care unit section of nursing home in St Louis, MO. This section was a locked-off area where individuals were closely monitored.</td>
<td>Older patients with diagnosis of dementia and Mental Status (SLUMS) examination score of ≤ 20

N = 10 completed the study but 2 had incomplete data and were excluded from the analysis (Of the 13 initially included, 2 did not satisfy the inclusion criteria and 1 was unwilling to participate; the remaining 10 participated in the study).

Age (mean) (years) for the 8 analyzed: 88

% Female (for the 8 analyzed): 75</td>
<td>Snoezelen program versus exercise program.

The Snoezelen program used sensory equipment to provide visual, auditory, tactile and olfactory stimulations.

The exercise program consisted of 20 minutes of moderate walking around the nursing home and 10 mins of light weight lifting.

For both interventions, each intervention consisted of three 30-minute sessions per week, for 3 weeks

A researcher conducted each program, and outcomes were assessed by the individual’s primary nurse.</td>
<td>Agitation

Outcome measure (CMAI short form)

Treatment duration: 3 weeks for each intervention</td>
</tr>
</table>

Author, Year, Country	Study Design	Population Characteristics	Comparison	Outcome
Goto,[8] 2014, USA	This was a prospective study. Individuals were recruited in two batches, 18 individuals in 2010 and 18 individuals in 2011 Setting: Assisted living facility (Francis E. Parker Memorial Home in Piscataway, NJ)	Healthy elderly Caucasian individuals (70% with diagnosis of Alzheimer's disease and 30% with other dementias). Mini-Mental Status Exam scores < 12. N = 36 Age (mean) (years): 88 % Female: 69.4	Snoezelen room providing multisensory stimulations versus a natural environment (Japanese style garden in a comparably sized room in the same nursing facility). There was a year gap between the two interventions. Six individuals participated in both interventions. Individual was exposed to each environment for 15 minutes, twice a week.	Behavior Outcome measure: Behavioral Assessment Check List, and qualitative. Intervention duration: continued for 3 weeks for Snoezelen environment; and for 4 weeks for garden environment.

BANS-S = Bedford Alzheimer Nursing Severity Scale; CMAI = Cohen-Mansfield Agitation Inventory; CSDD = Cornell Scale for Depression in Dementia; GDS = Global Detrioration Scale; MSSE = multisensory stimulation environment; NPI = Neuropsychiatry inventory; NR = not reported; QEBAGS = Queen Elizabeth Behavioral Assessment Graphical Scale; RAID = Rating Anxiety in Dementia; SD = standard deviation; SMMSE = Severe Mini-Mental State Examination

Table 4: Explanation of Outcome Measures

Outcome Measure	Reference (first author)	Explanation
BANS-S	Sanchez[6]	It is a 7-item scale with each item is scored on a 4-point scale. Total score ranges from 7 to 28. Higher score indicates more severe impairment. It has good internal consistency (Cronbach's alpha = 0.80) and convergent validity with other cognitive and functional scales (r = 0.62 to 0.79)
CMAI	Sanchez[6]	It is a 30-item scale with each item rated on a 7-point scale. Higher score indicates worse agitated behavior. It has inter-reliability, 0.88 to 0.92, and internal consistency reliability (Cronbach's alpha,0.86 to0.91)
CMAI (short form)	Berkheimer[18]	It is an inventory that includes 14 agitated behaviors, each rated on a 5-point scale. Inter-rater reliability for exact agreement is 0.82 and 0.92 for 0 to 1 point discrepancy
CSDD	Sanchez[6]	It is a 7-item scale with each item scored on a scale of 0 to 2 Higher score indicates worse mood. It has good test-retest reliability (0.61 to 0.84), and good internal consistency (Cronbach's alpha = 0.81)
Interact during	Maseda[17]	A 22 item scale (version of Interact), using for each item a 5-point Likert scale (ranging from 1 = not at all, to 5 = nearly all the time) and scored according to frequency of occurrence of each behavior.
Interact short	Maseda[17]	A 12 item scale (version of Interact), to assess mood and behavior during the 10 minutes immediately before the session, and 10 minutes immediately following the session. A 5-point Likert scale (ranging from 1 = not at all, to 5 = nearly all the time) was used for each item
NPI	Sanchez[7]	Total score ranges from 0 to 144. Higher score indicates worse behavior. It has good internal consistency (Cronbach's alpha = 0.85) and interrater reliability (0.63 to 1.00)

Outcome Measure	Reference (first author)	Explanation
QEBAGS (modified)	Bauer[11]	Each item is measured on a 4-point scale. Higher score indicates worse condition
RAID	Sanchez[6]	It is a 20-item scale with each item rated on a 4-point scale (0 to 3).Higher score indicates more anxiety symptoms. It has good internal consistency (Cronbach's alpha = 0.83), interrater reliability (0.82 to 1.00), and test-retest reliability (0.84 to 1.00)
SMMEE	Sanchez[6]	It is a 10-item scale. Total score ranges from 0 to 30. Lower score indicates worse cognitive state. It has good internal consistency (Cronbach's alpha = 0.88), inter-rater reliability (0.69 to 1.00), and test-retest reliability (0.64 to 1.00)

BANS-S = Bedford Alzheimer Nursing Severity Scale; CMAI = Cohen-Mansfield Agitation Inventory ; CSDD = Cornell Scale for Depression in Dementia; NPI = Neuropsychiatry inventory; QEBAGS = Queen Elizabeth Behavioral Assessment Graphical Scale; RAID = Rating Anxiety in Dementia; SMMSE = Severe Mini-Mental State Examination;

Table 5: Characteristics of Included Guidelines

First Author/ Group, Year, Country	Objective	Guideline Development Group, Target Users	Methodology
AOTA (National Guideline Clearinghouse assessment),[19] 2018, USA	Aim: To provide recommendations for occupational therapy interventions for adults with Alzheimer's disease and related major neurocognitive disorders. with	Guideline development group: The guideline was authored by two occupational therapists, also holding academic positions at the University. Target users: Health care providers, nurses, occupational therapists, physicians, psychologists, and social workers	Systematic literature search was conducted. Articles were selected according to pre-defined inclusion and exclusion criteria and quality assessment was conducted. Evidence tables were presented in an Appendix in the original guideline document. The guideline document was reviewed by a group of content experts that included a consumer representative and policy experts. Recommendations were formulated using expert consensus Recommendations were graded.
NICE guideline,[2] 2006, UK	Aim: To provide recommendations for the identification, treatment, and care of individuals with dementia, and for support for the care-givers	Guideline development group comprised: clinicians, methodologists, health economists, occupational therapist, nurse, and care-giver representatives. Target users: Health and social care staff, and families and care-givers of people with dementia	Guideline development methodology was not specifically described but NICE guidelines are required to follow a systematic approach as described in the Guideline development manual (https://www.nice.org.uk/process/pmg6/chapter/introduction) Recommendations were not graded.

AOTA = American Occupational Therapy Association; NICE = National Institute for Health and Care Excellence

Table 6: Grade of Recommendations and Level of Evidence for Guidelines

Grade of Recommendations	Strength of Evidence
AOTA,[19] 2018, USA	
"A–There is strong evidence that occupational therapy practitioners should routinely provide the intervention to eligible clients. Good evidence was found that the intervention improves important outcomes and concludes that benefits substantially outweigh harm. B–There is moderate evidence that occupational therapy practitioners should routinely provide the intervention to eligible clients. There is high certainty that the net benefit is moderate, or there is moderate certainty that the net benefit is moderate to substantial. C–There is weak evidence that the intervention can improve outcomes. It is recommended that the intervention be provided selectively on the basis of professional judgment and patient preferences. There is at least moderate certainty that the net benefit is small. I–There is insufficient evidence to determine whether or not occupational therapy practitioners should be routinely providing the intervention. Evidence that the intervention is effective is lacking, of poor quality, or conflicting and the balance of benefits and harm cannot be determined. D–It is recommended that occupational therapy practitioners do not provide the intervention to eligible clients. At least fair evidence was found that the intervention is ineffective or that harm outweighs benefits." Page 4 of 15	"Level I Systematic reviews, meta-analyses, and randomized, controlled trials Level II Two groups, nonrandomized studies (e.g., cohort, case control) Level III One group, nonrandomized (e.g., before-after, pretest and posttest) Level IV Descriptive studies that include analysis of outcomes (e.g., single-subject design, case series) Level V Case reports and expert opinions, which include narrative literature reviews and consensus statements" Page 5 of 15
NICE,[2] 2006, UK	
Not reported	Not reported

AOTA = American Occupational Therapy Association; NICE = National Institute for Health and Care Excellence

Appendix 3: Critical Appraisal of Included Publications

Table 7: Strengths and Limitations of Systematic Reviews and Meta-Analyses using AMSTAR[13]

Strengths	Limitations
Lorusso,[16] 2018, USA	
• The objective was clearly stated. • The inclusion criteria were stated. • The exclusion criteria were stated • Multiple databases were searched (PubMed, CINAHL, PsycINFO, Web of Science, and ERIC). In addition, abstracts and reference lists of reviewed articles were searched. Literature search time period of was not mentioned. • Flow chart of study selection was provided • List of included studies was provided • Characteristics of the individual studies were provided. • Quality assessment was conducted using Levels of Evidence for Health Care Design (Of the 12 studies, 8 were rated as Level 2; 3 were rated as Level 3a, and one was rated as Level 5) Level 2: "*Well-designed experimental (randomized) or quasi-experimental (non-randomized) studies with a low attrition rate, intention to treat analysis, blinding, masked randomization, and consistent results compared with other similar studies*" Page e170 Level 3a: "*Observational studies with a cohort design; experimental or quasi-experimental studies that did not fulfill the criteria for Level 2*" Page e170 Level 3b: "*Cross-sectional studies or case-control studies; qualitative research that, based on a literature review, on a theoretical framework, reports a clear method and considers a diversity of views*" Page e170 Level 5:"*Qualitative research that did not meet criteria of Level 3b"* Page e170 • Characteristics of the individual studies were provided.	• Study selection was not explicitly described, however flow chart of study selection was presented. • List of excluded studies was not provided • Unclear if article selection was done in duplicate • Unclear if data extraction was done in duplicate • Unclear if quality assessment of each individual study was conducted using a quality assessment tool. The level evidence was rated according to Evidence for Health Care design (indicated in the adjacent column) • Meta-analysis was not conducted • Unclear if publication bias was explored • Conflicts of interest were not mentioned.
Strom,[3] 2016, Norway	
• The objective was clearly stated. • The inclusion criteria were stated. • The exclusion criteria were stated • Multiple databases were searched (PubMed [Medline], CINAHL, PsycINFO, and the Cochrane library). In addition, hand searching was done • Study selection was described • Flow chart of study selection was provided • List of included studies was provided • List of excluded studies could be obtained by requesting it from the corresponding author • Article selection was done in duplicate (one reviewer reviewed all the articles and two reviewers reviewed one half of the total articles, each.	• Unclear if data extraction was done in duplicate however quality assess was done by all three reviewers • Details of patient characteristics and interventions were lacking • Meta-analysis was not conducted • Unclear if publication bias was explored

Strengths	Limitations
• Quality assessment was conducted using CASP. For the 7 Snoezelen studies, 5 studies had scores ≥ 9, indicating good quality (the other two studies had scores of 7 and 8). The two Sonas studies had scores of 10 (indicating good quality) each. • Characteristics of the individual studies were provided, but details were lacking. • The authors mentioned that there were no conflicts of interest	

Table 8: Strengths and Limitations of Clinical Trials using Downs and Black checklist[14]

Strengths	Limitations
Randomized controlled trials	
Maseda,[17] 2018, Spain	
• The objective was clearly stated • The inclusion and exclusion criteria were stated • Patient characteristics, intervention and outcomes were described. • Randomization was via computer-based random number generator • All participants were analyzed. • *P* values were presented • Disclosure of conflicts of interest were available on-line and the authors had nothing to declare	• Due to nature of the study, blinding of participant and therapist was not possible • Unclear if sample size calculation was conducted.
Sanchez,[6] 2016, Spain	
• The objective was clearly stated • The inclusion and exclusion criteria were stated • Patient characteristics, intervention and outcomes were described. • Randomized was via computer-based random number generator • Of the 22 patients, 18 remained during follow-up (3 deaths and 1 drop-out), i.e., drop-out rate = 18.1% • Findings were presented graphically and analyzed using repeated measures two-away mixed ANOVAs. • *P* values were presented • Disclosure of conflicts of interest were available on-line and the authors had nothing to declare	• Due to nature of the study, blinding of participant and therapist was not possible • Unclear if sample size calculation was conducted.
Sanchez,[7] 2016, Spain	
• The objective was clearly stated • The inclusion and exclusion criteria were stated • Patient characteristics, intervention and outcomes were described. • Randomized was via computer-based random number generator • Of the 32 patients, 27 remained during follow-up (4 deaths and 1 drop-out), i.e., drop-out rate = 18.5%.	• Due to nature of the study, blinding of participant and therapist was not possible • Unclear if sample size calculation was conducted.

Strengths	Limitations
• Findings were presented graphically and analyzed using repeated measures two-away mixed ANOVAs. • *P* values were presented • The authors mentioned that there were no potential conflicts of interest with respect to research, authorship, and/or publication of the article	
Observational studies	
Anderson,[9] 2011, Australia	
• The objective was clearly stated • Patient characteristics, interventions, and outcomes were described but patient characteristics lacked details • *P* values were presented	• The inclusion and exclusion criteria were not explicitly stated • Description of patient characteristics lacked details • Not randomized • Due to nature of the study, blinding of participant and therapist was not possible • Unclear if sample size calculation was conducted • Unclear if there were any drop-outs • Unclear if all patients were included in the analysis • Conflicts of interest were not mentioned
Bauer,[11] 2015, Australia	
• The objective was clearly stated • Patient characteristics and outcomes were described. There were imbalances in patient characteristics between the two groups • There appears to be no drop-outs • All patients appear to have been included in the analysis • *P* values were presented • The authors mentioned that there were no potential conflicts of interest	• The inclusion and exclusion criteria were not explicitly stated • Description of interventions lacked details • Not randomized • Due to nature of the study, blinding of participant and therapist was not possible • Unclear if sample size calculation was conducted.
Berkheimer,[18] 2017, USA	
• The objective was clearly stated • The inclusion and exclusion criteria were stated • Patient characteristics, interventions, and outcomes were described • Of 10 patients who completed the study, 2 did not have complete data and were not included in the analysis • *P* value was presented • The authors mentioned that there were no potential conflicts of interest	• Not randomized • Due to nature of the study, blinding of participant and therapist/researcher was not possible. However the assessment was done by the patient's primary nurse • Unclear if sample size calculation was conducted.
Goto,[8] 2014, USA	
• The objective was clearly stated • Patient characteristics, interventions, and outcomes were described • There appears to be no drop-outs • All individuals appear to have been included in the analysis • *P* value was presented but not always • Disclosure of conflicts of interest were available on-line and the authors had nothing to declare	• The inclusion and exclusion criteria were not explicitly stated • Not randomized • Due to nature of the study, blinding of participant and therapist was not possible • Unclear if sample size calculation was conducted.

ANOVA = analysis of variance;

Table 9: Strengths and Limitations of Guidelines using AGREE II[15]

Strengths	Limitations
AOTA,[19] 2018, USA	
• The scope and purpose were clearly stated. • The guideline was authored by two occupational therapists also holding academic positions at the University. • A systematic review was conducted using standard methodology • Evidence tables were reported to be available in an Appendix in the original document. • Recommendations were graded using the approach of the U.S. Preventive Services Task Force. • The guideline document was reported as peer-reviewed, and was reviewed by a group of content experts that included a consumer representative and policy experts. • Appears to have a process for updating the guidelines • It was reported that the authors had no conflicts of interest that would impact this work	• Unclear if patient preferences were considered • Cost analysis was not conducted and published cost analyses were not reviewed
NICE guideline,[2] 2006, UK	
• The scope and purpose were clearly stated. • Details of the methodology used was not described but the guideline was developed according to the NICE guideline development manual (https://www.nice.org.uk/process/pmg6/chapter/introduction and https://www.nice.org.uk/media/default/about/what-we-do/our-programmes/developing-nice-guidelines-the-manual.pdf). According to the manual, guideline development group comprises of experts in the area as well as lay persons. Members of the group are required to declare conflicts of interest and in case of any potential conflict of interest, appropriate measures are taken. Input from people using health care services, carers and the public are also sought. Guidelines are based on best available evidence. Resource implications are considered. The guideline document undergoes external review. There are also regular checks to determine if updating the guideline is required	• Evidence on which the recommendations were based was not provided • Recommendations were not graded

Appendix 4: Main Study Findings and Author's Conclusions

Table 19: Summary of Findings of Included Studies

<table>
<tr><th>Main Study Findings</th><th>Author's Conclusion</th></tr>
<tr><td colspan="2">Systematic review</td></tr>
<tr><td colspan="2">Lorusso,[16] 2018, USA</td></tr>
<tr><td>Population: Individuals with clinical diagnosis of dementia; majority > 65 years

Effects of MSE therapy
<table>
<tr><th>No of studies</th><th>Findings from the studies</th></tr>
<tr><td>5</td><td>Number of BPSD incidences decreased with use of MSE therapy</td></tr>
<tr><td>4</td><td>Positive changes in mood/behavior with use of MSE therapy</td></tr>
<tr><td>1</td><td>Positive changes in engagement with use of MSE therapy</td></tr>
<tr><td>2</td><td>Positive changes with respect to function (activities of daily living), with use of MSE therapy</td></tr>
<tr><td>3</td><td>No significant between-group differences were found when MSE therapy was compared with one-to-one interventions.</td></tr>
<tr><td>3</td><td>Observed positive effects with MSE therapy did not last significantly beyond the treatment sessions.</td></tr>
<tr><td>1</td><td>Long term (12 weeks after treatment) benefits of MSE therapy were found</td></tr>
</table></td><td>The authors mentioned that "Evidence supports the positive impact of sensory stimulation as a nonpharmacological behavioral treatment for dementia. […..] Significant differences were not found in the between-group studies when MSE was compared with other one-to-one interventions. Results on long-term effects were mixed. Variations can be seen in terms of research methods, types of environmental interventions, duration, and specific characteristics of participants, thus confounding the reliability of findings." Page e168</td></tr>
<tr><td colspan="2">Strom,[3] 2016, Norway</td></tr>
<tr><td>Population: Individuals with dementia

Effects of multisensory therapy (Snoezelen [SNZ])
<table>
<tr><th>Comparison</th><th>No. of studies</th><th>Target</th><th>Main findings</th></tr>
<tr><td>SNZ vs activities</td><td>1</td><td>Behavior, mood or cognition.</td><td>No significant between-group differences with respect to change in behavior, mood or cognition.
Behavior was stable in both groups</td></tr>
<tr><td>SNZ vs normal living room activities</td><td>1</td><td>Well-being</td><td>Significantly more reported sadness in the living room than Snoezelen</td></tr>
<tr><td>SNZ vs activities</td><td>1</td><td>Balance</td><td>No significant effect of unstructured Snoezelen</td></tr>
<tr><td>SNZ vs reminiscence</td><td>1</td><td>Agitation</td><td>No significant between group difference</td></tr>
<tr><td>SNZ vs gardening</td><td>1</td><td>Function</td><td>No significant between-group difference. Both groups showed improvement in motor skills</td></tr>
<tr><td>SNZ (twice weekly) vs SNZ (once weekly) vs usual care</td><td>1</td><td>Behavior</td><td>Significant differences documented for SNZ treatments compared with usual care at 8 weeks and 24 weeks.
No significant differences between the two SNZ groups at week 4 and week 8 weeks but at week 12 and week 24</td></tr>
<tr><td>SNZ vs usual care</td><td>1</td><td>Behavior and mood</td><td>Significant effect on behavior and well being</td></tr>
</table></td><td>The authors mentioned that "About half of the studies on massage/aromatherapy, doll/animal assisted therapy/toy therapy and Snoezelen reported effect, mainly reduced agitation, as well" Page 1813

The author also mentioned that "More high quality research is recommended, especially regarding studies measuring the effect on QoL and communication, and if the effect depends on the stage of dementia." Page 1814</td></tr>
</table>

Main Study Findings	Author's Conclusion

Effects of Sonas program

Comparison	No. of studies	Target	Main findings
Sonas vs usual care	1 (Hutson)	BPSD, QoL, depression, anxiety, communications	No significant improvements in QoL, BPSD, depression, anxiety or communications after Sonas sessions
Sonas vs usual care	1 (Jackson)	Agitation, aggression, depression, cognition	No significant effect on agitation or aggression in any of the groups

Randomized controlled trial

Maseda,[17] 2018, Spain

Population: Older adults with severe dementia

Outcomes with statistically significant improvements with MSSE or individualized music (considering outcome items before and after treatment; assessment based on "Interact short")

Outcome items	MSSE		Individualized music	
	Effect size[a], Cohen's d	*P* value	Effect size[a], Cohen's d	*P* value
Happy/sad	0.55	0.001	0.39	0.013
Related to people well	0.39	0.023	0.19	0.034
Attentive/ focused on environment/objects	0.54	0.005	0.33	0.007
Enjoying self, active or alert	0.54	0.017	0.16	0.136
Relaxed, content or sleeping appropriately	0.80	0.021	0.38	0.100

[a]Absolute values

With respect to other items such as tearful or sad; fearful or anxious; confused; speech; and wandering, restless or aggressive, there were no statistically significant differences before and after treatment in both groups.

Repeated measures ANOVA results (group-time interactions)
Individuals in both groups were more happy and content; talked more spontaneous; related to people better; were more attentive and focused on their environment; enjoyed themselves; were less bored; and were more relaxed and content, in the 10 minutes after the session compared to 10 minutes before the sessions

Assessment based on "Interact during"
For the outcome item: "tracking observable stimuli", the MSSE group was found to be more observant than the music group ($P = 0.044$); while for the outcome item: "relaxed/content" the music group was found to be more relaxed ($P = 0.003$).

The authors mentioned that "This study evidences that both MSSE sessions and individualized music sessions are effective non-pharmacological treatments for the management of BPSD in people with severe dementia. MSSE sessions in Snoezelen room were found to be as effective as individualized music sessions, except during the intervention sessions, with differences in two of the analyzed parameters: 'tracking observable stimuli' and 'relaxed/content'; which means that the participants in MSSE group performed a better visual follow-up of the stimuli than the participants in the individualized music group, while participants in the music group were more relaxed and happy than those of the MSSE group."

<table>
<tr><th>Main Study Findings</th><th>Author's Conclusion</th></tr>
<tr><td colspan="2">Sanchez,[6] 2016, Spain</td></tr>
<tr><td>
Population: Older adults with severe dementia

Outcomes with MSSE and music interventions
<table>
<tr><th>Outcome (measure)</th><th>Finding[a]</th></tr>
<tr><td>Agitation (CMAI)</td><td>There was improvement in both groups between pre-, mid-, and post intervention (P = 0.031, η^2 = 0.031). There were no significant between group differences.</td></tr>
<tr><td>Mood (CSDD)</td><td>Between pre- and post- intervention, CSDD scores remained stable for MSSE group but worsened for music group, however results were not significant.
During the follow-up (i.e. post intervention to end of follow-up) both groups showed significant improvements (P = 0.006, η^2 = 0.374)</td></tr>
<tr><td>Anxiety (RAID)</td><td>A significant group-time interaction was found in RAID scores. Between pre- and post- intervention, there was improvement in the MSSE group but not in the music group. During the follow-up period there was improvement in both groups (P = 0.021, η^2 = 0.267). There were no significant between group differences.</td></tr>
<tr><td>Cognitive status (SMMEE)</td><td>Both groups showed a similar decline in scores during the trial. There were no between group differences.</td></tr>
<tr><td>Dementia severity (BANS-S)</td><td>A significant group-time interaction was found in BANS-S scores. Between pre- and post- intervention, there was improvement in the MSSE group but not in the music group. During the follow-up period both groups worsened but results were not significant</td></tr>
</table>
[a]Findings were presented graphically and analyzed using repeated-measures two-way mixed ANOVAs
</td><td>The authors mentioned that "These findings suggest that MSSE in a Snoezelen room could be more effective than individualized music sessions in reducing symptoms in patients with severe dementia. Patients treated with MSSE have shown positive effects on anxiety symptoms and dementia severity that were not observed in the individualized music group. With regard to agitation, there was similar improvement in both groups, with no significant differences between the two types of interventions. Future empirical studies with larger samples are necessary to compare the effects of MSSE in a Snoezelen room with other types of sensory intervention in people with severe dementia." Page 313</td></tr>
<tr><td colspan="2">Sanchez,[7] 2016, Spain</td></tr>
<tr><td>
Population: Older adults with severe dementia

Outcomes in MSSE, activity, and control groups
<table>
<tr><th>Outcome (measure)</th><th>Finding[a]</th></tr>
<tr><td>Agitation (CMAI)</td><td>There was improvement in both groups between pre-, mid-, and post intervention (P = 0.003, η^2 = 0.277). There were no significant between group differences. During the follow-up (i.e. post intervention to end of follow-up) period both groups worsened. There were no significant between group differences.</td></tr>
<tr><td>Behavioral and psychological (NPI)</td><td>A significant group-time interaction was found with NPI scores on comparing MSSE group with the activity group. Individuals in the MSSE. Between pre- and post- intervention, the MSSE group showed a significant higher improvement than the activity group. There were no significant differences between MSSE and control groups.</td></tr>
<tr><td>Mood (CSDD)</td><td>Between pre- and post- intervention, CSDD scores remained stable for all three groups. During the follow-up period both the MSSE group and the activity group worsened, but the results were not significant.</td></tr>
</table>
</td><td>The authors mentioned that "These results support the idea that MSSE could be more effective than one-to-one activity sessions for reducing symptoms in patients with severe dementia. In the current study, a positive effect on neuropsychiatric symptoms and dementia severity in the MMSE treatment was observed in comparison with the activity group. With regard to agitation, the improvement in the MSSE and the activity group was similar, with no significant differences between the 2 types of intervention. However, in general, the improvements found during the intervention were lost in the follow-up period, indicating that it is necessary to continue with the intervention over time to maintain the positive effects." Page 349</td></tr>
</table>

Main Study Findings	Author's Conclusion

Cognitive status (SMMEE)	The MSSE group and the activity group showed improvement during the intervention. During the follow-up period, a significant time effect was found, with decrease in scores in both groups ($P = 0.017$, $\eta^2 = 0.324$), but no significant between group difference.
Dementia severity (BANS-S)	Between pre- and post- intervention, there was improvement in the MSSE group but not in the other two groups. Significant group and time interactions were found for MSSE group compared to the activity group (($P = 0.024$, $\eta^2 = 0.171$), and with the control group ($P < 0.001$, $\eta^2 = 0.334$).

[a]Findings were presented graphically and analyzed using repeated-measures two-way mixed ANOVAs

Observational study

Anderson,[9] 2011, Australia

Population: Older adults with severe dementia

Outcomes with Snoezelen sessions and garden sessions.

Intervention	No of individuals	Proportion ofdisturbed/ disengaged observations (%)		*P* value
		Before session	After session	
Snoezelen session	9	28.21	10.19	0.09
Garden session	5	13.3	1.43	0.22

Across time, there were no significant differences in observations for any of the four categories: "very engaged" ($P > 0.05$); engaged ($P > 0.05$); neutral ($P > 0.05$); and disengaged ($P > 0.05$).

"In summary, there were no significant main effects for time and location, and there were no significant interactions between these two factors." Page 171

The authors mentioned that "The finding that the Snoezelen room had no advantage over visiting the garden may reflect that there is no difference, or it may be due to the small sample size. We cannot conclude definitively based on these results alone." Page 175

Bauer,[11] 2015, Australia

Population: Older adults with severe dementia

Outcomes with Snoezelen sessions and non-Snoezelen sessions (common best practice)

QEBAGS Score (explanation)	Number of behavioral observations			
	Snoezelen		Non-Snoezelen	
	T1	T3	T1	T3
1 & 2 (wandering/ restlessness stopped or improved)	19	14	28	26
3 (wandering/ restlessness ongoing)	4	6	2	1
4 (wandering/ restlessness worsened)	0	1	1	4
All categories	23	21	31	31
T1 = immediately after intervention, T3 = 60 minutes after the intervention				

Statistical significance of improvements in behavior with Snoezelen sessions and non-Snoezelen (using Wilcoxon signed-rank test**)**

The authors mentioned that "Although there were no obvious ill-effects observed as a result of the use of Snoezelen in this study, the absence of any significant observable benefit over and 'above common best practice' for the dementia related behaviors of wandering and restlessness nevertheless raises questions about the therapeutic and economic value of this intervention." Page 465

Main Study Findings	Author's Conclusion

Behavior	*P* values			
	Snoezelen		Non-Snoezelen	
	T1	T3	T1	T3
Wandering and restlessness	< 0.001	< 0.01	< 0.001	< 0.01
T1 = immediately after intervention, T3 = 60 minutes after the intervention				

Between group (Snoezelen sessions versus non-Snoezelen) differences in improvements in behavior (using Wilcoxon signed-rank test**)**

Behavior	*P* values		
	T0	T1	T3
Wandering and restlessness	0.37	0.61	0.80
T0 = pre-intervention; T1 = immediately after intervention, T3 = 60 minutes after the intervention			

Berkheimer,[18] 2017, USA

Population: Older adults with dementia

Behavior (agitation) following Snoezelen sessions and exercise session

Time point	CMAI short form scores		*P* value
	Average	Change from baseline	
Baseline	33.1	NA	NA
Post-exercise	26.6	6.5	< 0.10 (not significant)
Post-Snoezelen	27.1	6	

The authors mentioned that "Though it cannot be concluded from this pilot study that snoezelen therapy and exercise therapy are able to produce a significant reduction in the agitation of patients with dementia, the data do suggest that there is a trend toward such a reduction. This study also provides evidence, that snoezelen therapy and exercise therapy may have similar effects reducing agitation in nursing home patients with dementia." Page 1090

Goto,[8] 2014, USA

Population: Healthy older adults with dementia (70% with Alzheimer's disease, 30% other dementia)

Outcomes using Snoezelen environment and Japanese garden environment

Outcome	Snoezelen environment	Japanese garden environment	*P* value
Remaining awake in the environment (score, mean ± SD)	2.5 ± 2.35	12.63 ± 2.35 (responses more positive and more consistent)	< 0.0001
Behavioral Assessment Check List	Negative shift	More engagement and better mood	NR
Proportion of individuals showing verbal expression	24%	56%	NR

The authors mentioned that "The Snoezelen room is meant to stimulate the senses; however, the subjects did not interact with most items even when the assistant offered them. [……] In the Japanese garden, by contrast the subjects stayed awake, were alert and spoke." Page 995

The authors mentioned that "It should also be stressed that though our results are significant, we view them as a pilot study only. In particular, we have only established data for our subjects during the exposures themselves. We were not able to monitor whether there were any long-lasting effect of the exposure in the state of the subjects and so cannot say whether there was any persistent benefit from the exposures." Page 996

ANOVA = analysis of variances; BANS-S = Bedford Alzheimer Nursing Severity Scale; BPSD = behavioral and psychological symptoms; CMAI = Cohen-Mansfield Agitation Inventory ; CSDD = Cornell Scale for Depression in Dementia; MSE = multisensory environment; NPI = Neuropsychiatry inventory; NA = not applicable; NR = not reported; RAID = Rating Anxiety in Dementia; SMMSE = Severe Mini-Mental State Examination;

Appendix 5: Evidence-Based Guidelines

Table 11: Guideline Recommendations

Evidence	Recommendations
AOTA,[19] 2018, USA	
Evidence for the recommendations were reported to available in an Appendix in the original guideline document, which we were unable to access	This guideline recommended several environment-based interventions for improving behavior and perception, and for reducing falls in adults with Alzheimer's disease and related major neurocognitive disorders. Multisensory interventions were included among these. It was recommended that: "Multisensory interventions (e.g., Snoezelen®) for short-term behavior improvements (A)" Page 3 of 15 "Multisensory interventions (e.g., Snoezelen®) for long-term behavior improvements (D)" Page 4 of 15
NICE,[2] 2006, UK	
Evidence for the recommendation was not presented but it was mentioned that "Health and social care staff in the NHS and social care, including care homes, should work together to ensure that some of these options are available, because there is some evidence of their clinical effectiveness. More research is needed into their cost effectiveness." Page 30	"For people with all types and severities of dementia who have comorbid agitation, consideration should be given to providing access to interventions tailored to the person's preferences, skills and abilities. Because people may respond better to one treatment than another, the response to each modality should be monitored and the care plan adapted accordingly. Approaches that may be considered, depending on availability, include: • aromatherapy • multisensory stimulation • therapeutic use of music and/or dancing • animal-assisted therapy • massage. These interventions may be delivered by a range of health and social care staff and volunteers, with appropriate training and supervision." Page 30 "A range of tailored interventions, such as reminiscence therapy, multisensory stimulation, animal-assisted therapy and exercise, should be available for people with dementia who have depression and/or anxiety." Page 36

AOTA = American Occupational Therapy Association; NHS = National Health Services; NICE = National Institute for Health and Care Excellence; UK = United Kingdom; USA = United States of America

Appendix 6: Overlap between Included Systematic Reviews

Table 12: Primary Study Overlap between Included Systematic Reviews

Primary Study Citation	Systematic Review Citation	
	Larusso,[16] 2018, USA	Strøm,[3] 2016, Norway
Baker 2001	y	
Baker 2003	y	y
Baillon 2004		y
Baillon 2005	y	
Collier 2010		y
Cornell 2004	y	
Cox 2004		y
Klages 2011		y
Maeseda 2014a	y	
Maeseda 2014b	y	
Milev 2008	y	y
Minner 2004	y	
Riley-Doucet 2009	y	
Riley-Doucet 2013	y	
Staal 2007	y	
van Weert 2005		y
Ward Smith 2009	y	