

# Psychosocial and Environmental Treatment Approaches for Behavioral and Psychological Symptoms in Neurocognitive Disorders: an Update and Future Directions

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## Opinion Statement

Nearly all persons with dementia will exhibit behavioral and psychological symptoms (BPSD) at some point during the course of the disease. These symptoms often pose significant challenges for formal and informal caregivers, and their treatment is unclear. Current guidelines recommend implementing nonpharmacological interventions as the first-line approach to managing BPSD. Given the recent proliferation of research evaluating the use of nonpharmacological interventions for BPSD, there is a continuing need to reevaluate and synthesize the findings in this area. The current review examines the evidence for using psychosocial and environmental strategies, focusing on the past 3 years of research efforts and assessing how this research augments what is known from prior reviews. We conclude that the results in the recent literature concerning the efficacy of

psychosocial and environmental treatment approaches to behavioral symptoms in dementia continue to be promising, yet results are also mixed. We recommend the consideration of music therapy and tailored activities when utilizing a nonpharmacological approach, as these appear particularly promising throughout the literature. We also find that multisensory stimulation and animal-assisted therapy warrant further evaluation. In contrast, in this and previous reviews, approaches such as bright light therapy and aromatherapy have consistently been shown to be ineffective and, thus, cannot be recommended with confidence based on the evidence. We discuss limitations of current research studies and make recommendations for future research in the area of psychosocial and environmental interventions for BPSD.

## Introduction

Behavioral and psychological symptoms of dementia (BPSD) are a hallmark feature of dementia—also known as neurocognitive disorders—for the nearly 47 million people worldwide who have this disorder [1]. Also referred to as neuropsychiatric symptoms (NPS), behavioral symptoms, neurobehavioral symptoms, or behavioral disturbances, this term encompasses a wide range of behavioral and psychiatric symptoms with multifactorial etiologies. These complex etiologies may include biological changes in the brain, biological stressors (e.g., medical illness), changes in executive functioning and information processing, increased vulnerability to an individual's relationships and interactions with their physical and social environment, unmet needs, deterioration of effective coping mechanisms, or a combination of factors [2–6].

An increase in the frequency and severity and incidence and prevalence of BPSD tends to parallel dementia progression for most behaviors, although behavioral occurrences are episodic and occur across disease progression [7]. When combined with the concurrent need for more comprehensive and complex levels of care as dementia progresses, BPSD commonly lead to more expensive care measures including hospitalizations, increased time in caregiving, and long-term care placement [8–10]. Not surprisingly, prevention and management of BPSD are among the most challenging, burdensome, and costly aspects of dementia care. Behavioral symptoms often signal the need for more intense caregiving ([11, 12], Jutkowitz et al., under review) and are a significant source of stress for family members, formal caregivers [2, 12], residential staff [13, 14], and hospital staff [15, 16].

The ascertainment of BPSD is sorely neglected in all care settings, although published quality indicators such as those from the American Association of Neurology [17]

and the International Consortium for Health Outcomes dementia measurement sets for clinicians include indicators for assessing BPSD, educating family caregivers, and using nonpharmacological treatment approaches.

Moreover, the treatment of BPSD remains unclear and inconsistent. As to pharmacological treatments, guidelines advise that antipsychotics should only be used in patients with severe distress and after a risk-benefit analysis, with limited dose and treatment duration and attempts at discontinuation [4, 18]. In 2012, the American Geriatrics Society recommended avoiding initiating antipsychotic use or limiting its use with older adults due to increased mortality from cerebrovascular events. Additional side effects of antipsychotic therapy can include falls, extrapyramidal symptoms, metabolic effects, infections, decreased quality of life, and further cognitive decline [19, 20], all of which tend to be most pronounced in persons with severe dementia.

Thus, most medical associations have endorsed the use of nonpharmacological approaches as first-line treatment for dementia-related behavioral symptoms [21–23, 24•]. These interventions are commonly classified as psychosocial, which addresses aspects of psychological and social behaviors and symptoms of dementia [25], and environmental, which denotes environmental modifications or interventions affecting specific environmental attributes [26] and has recently been referred to as ecopsychosocial interventions [27].

Over the past 30 years, there has been an increased emphasis on the use of psychosocial and environmental approaches and a proliferation of studies to evaluate their effectiveness on BPSD in different contexts. Among other positive outcomes, these interventions have been shown to decrease the frequency and severity of behaviors, increase engagement, and improve quality of life [28, 29•,

30]. Furthermore, studies show that teaching caregivers to use specific nonpharmacological approaches (e.g., effective communication techniques, environmental simplification) can significantly decrease caregiver burden and occurrences of behavioral symptoms and enable persons with dementia to remain in the community longer [25, 31, 32]. Nevertheless, these approaches have not been integrated into routine clinical care for a variety of reasons, as the assessment for BPSD and introduction of strategies requires time on the part of practitioners and because limited time and reimbursement structures typically prohibit their use. Furthermore, practitioners may not be aware of the level of evidence for strategies or trained in their use.

In this article, we examine the evidence for using psychosocial and environmental strategies, focusing on the most recent (i.e., past 3 years) research efforts from which to draw conclusions and recommendations. While there have previously been numerous systematic reviews of nonpharmacological approaches [25, 33–38], findings have been inconsistent although suggestive of potential benefit. For example, a meta-analysis of interventions providing caregiver education, support, and skills showed overall improvements in behavioral symptoms in persons with dementia [25]. Other reviews of intervention studies of a wide range of home-based interventions such as exercise, activity, and environmental supports show improvements in various outcomes including quality of life, behavioral symptoms, and overall well-being [2] as well as slowed rate of physical functional decline [39].

As research in this area grows, so does the need to evaluate evidence for use of recent advances. Given the strong associations of BPSD with caregiver burden and long-term care placement, as well as the substantial risks of using pharmacotherapies in older adults with dementia, it is critical to develop, evaluate, and disseminate effective interventions to prevent and/or manage and reduce behavioral symptoms. We begin by examining the theoretical basis for nonpharmacological strategies and then proceed with a systematic review of only the most recent evidence (past 3 years), followed by a discussion of the implications of this growing robust body of research for knowledge transfer to the clinical setting.

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### **Why should nonpharmacological approaches be effective?**

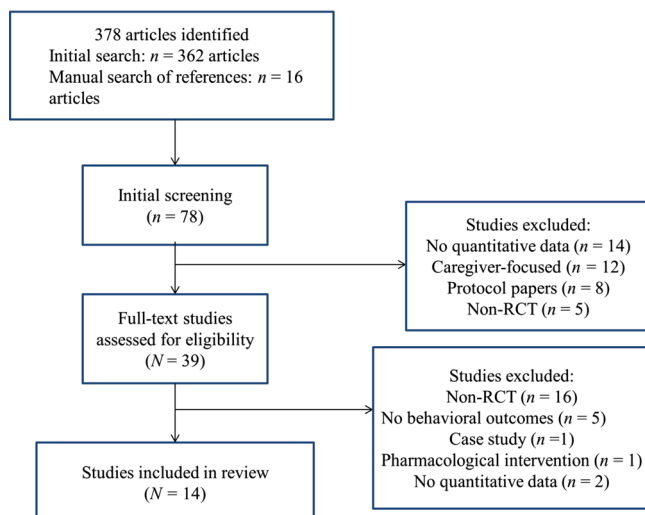
Four theoretical frameworks in particular have been applied to conceptualizing dementia-related behaviors

and provide a rationale for using nonpharmacological approaches. These are (1) the neurobiological/genetic framework [40–42], (2) the behavioral model [43], (3) the reduced stress threshold model [44, 45], and (4) the unmet needs model [46].

In brief, the neurobiological/genetic model proposes that behavioral symptoms are the result of dementia-related changes in the brain [40–42]. This in turn heightens the individuals' vulnerabilities to their environment such that they may not be able to process cues or new information, resulting in frustration, agitation, and other behavioral manifestations. According to the behavioral model, also known as the "ABC model," the consequences of behaviors positively or negatively reinforce the relationships between the antecedents (or triggers for a particular behavior) and the behavioral occurrence. This model suggests that removing antecedents or modifiable triggers may prevent the behaviors or facilitate better management when they occur [43].

The reduced stress threshold model, also known as the progressively lowered stress threshold (PLST) or environmental vulnerability model, postulates that individuals become increasingly vulnerable to the environment and experience the environment as more stressful as dementia progresses [44, 45]. The stress threshold becomes lower as day progresses (and also with disease progression), such that stimuli result in heightened anxiety and behavioral symptoms. The PLST model suggests that a stimulus that may be acceptable or manageable for a cognitively intact person may elicit an overreaction from or be perceived as stressful by a person with dementia [40, 45]. Finally, the unmet needs model, also referred to as the needs-driven dementia-compromised behavior model, posits that behavioral symptoms are the result of attempts to communicate physical or psychic distress related to unmet needs [46], as well as from the reduced capacity to effectively engage or use the environment to accommodate needs [40].

These theoretical models are not mutually exclusive and may be complementary [33]. Of importance is that each suggests that BPSD may be due to one or more factors that are modifiable (e.g., a trigger in the environment or unmet need) and hence would be responsive to a nondrug intervention. These models may also help to account for different behaviors in different persons with dementia or for different catalysts of the same behavior.



**Fig. 1.** Search flowchart.

Each of these models and/or their combination can be used to guide a nonpharmacological intervention for behavioral and psychological symptoms of dementia.

## Methods

To examine the most recent state-of-the-science in this area, we conducted a rapid review of studies using the following criteria: (a) use of a randomized, controlled trial design and/or reviews or meta-analyses of randomized controlled trials (RCTs); (b) published in the past 3 years; (c) in English; (d) evaluation of a nonpharmacological intervention; and (e) inclusion of a measure of BPSD as an outcome. We excluded interventions that only reported caregiver outcomes although they may have included instruction in behavioral management. A comprehensive computerized search of peer-reviewed published studies (January 1, 2013–October 10, 2016) was conducted in Cochrane, PubMed, CINAHL, CINAHL Plus, PsycINFO, Medline, Google Scholar, Ovid, and EBSCO using the following search terms: *dementia, neurocognitive disorders, psychosocial, environmental, environment, nonpharmacological, treatment, intervention, behaviors, behavioral disturbances, behavioral symptoms, neuropsychiatric symptoms, behavioral and psychological symptoms of dementia, aromatherapy, cognitive, music, bright light, massage, multi-sensory stimulation, Snoezelen, exercise, animal-assisted therapy, burden, and stress.*

Additionally, a search of meta-analyses, review papers, and book chapters was conducted and the reference sections were cross-checked with the original search. Papers identified through this secondary process were further examined for additional references related to relevant studies.

All studies meeting inclusion criteria were appraised for design strength and quality of evidence using the National Health and Medical Research Council [47, 48] criteria for rating studies to assess the effectiveness of interventions. Level I evidence, the highest level, is produced by a systematic review of level II studies, which are RCTs. Level III-1 is a pseudorandomized controlled trial, level

Table 1. Characteristics of studies included in this review

Reference	Study design/location	LOE	Sample size	Age range	Intervention
Ballard et al. [49]	RCT/SNF	II	195	Mean = 85.26	Exercise $\geq 1$ h/week of exercise or increase in exercise by 20% after 9 months (Antipsychotic review versus an intervention to increase social interaction versus a personalized exercise intervention)
Brunelle-Hamann et al. [50]	RCT/US	II	15	Mean = 80.47	Cognitive rehabilitation 45–60 min session, twice a week for 4 weeks (Randomly assigned to cognitive rehabilitation program to learn/relearn an instrumental activity of daily living or wait-list control)
Chang et al. [51]	Meta-analysis of 10 RCTs/SNF, ALF	I	465	65–87	Music therapy 30–65 min for 4–16 weeks
D'Onofrio et al. [52]	RCT/CD	II	90	69–87	Cognitive stimulation 90 min once/week for two 2-month cycles (Rivastigmine transdermal patch versus rivastigmine transdermal patch combined with cognitive stimulation)
Forbes et al. [53•]	Meta-analysis of 11 RCTs (5 with behavioral outcomes)	I	154	61–99	Bright light therapy 10 days–3.5 years
Fu et al. [54]	RCT/SNF	II	67	61–93	Aromatherapy All treatments were given twice a day at two time periods, 7 days a week for 6 weeks (Randomly assigned to combination aromatherapy and hand massage, aromatherapy, or water spray placebo control)
Lowery et al. [55]	RCT/CD	II	131	58–99	Exercise 20–30 min at least 5 times per week for 12 weeks (Personalized exercise versus treatment as usual)
Majić et al. [56•]	RCT/SNF	II	54	Mean = 81.7	Animal-assisted therapy Once a week for up to 45 min for 10 weeks (Interaction with border collie and dog therapy guide versus usual care)
Moyile et al. [57]	RCT/ALF, SNF, RH	II	55	74–103	Massage 5 min once per day, 5 days per week for 6 weeks (foot massage versus quiet presence of staff member)
O'Connor et al. [58•]	RCCT/SNF	III-1	64	Mean = 77.6	Aromatherapy Three applications with a 30-min observation over a 1-week period (Randomly assigned to receive dermally applied,

**Table 1.** (Continued)

Reference	Study design/location	LOE	Sample size	Age range	Intervention
Pieper et al. [59]	CRCT/SNF	II	288	Unknown	neurophysiologically active, high purity 30% lavender oil or an inactive control oil) Multicomponent intervention Unspecified dose and intensity (Stepwise application of a physical needs assessment, an affective needs assessment, a trial of nonpharmacological comfort interventions, a trial of analgesics if needed, and consultation with other health-care professionals or practitioners or a trial of psychotropic drugs)
Sánchez et al. [60]	RCT/SNF	II	32	68–102	Multisensory stimulation (MSS) 30 min, twice per week for 16 weeks (Randomly assigned to 1 of 3 groups: MSS in a Snoezelen room, one-to-one activity, and a usual care control group)
Van Haitsma et al. [61•]	RCT/SNF	II	188	64–105	Individualized activities 10 min, 3 days per week for 3 weeks (Tailored activity versus standard activity of looking through a magazine and conversing versus usual care)
Yang et al. [62]	RCT/SNF	II	186	Unknown	Aromatherapy ≤15 min, once per day, 5 days per week for 4 weeks (Randomly assigned to aroma-acupressure group, aromatherapy group, and usual care group)

Reference	Behavioral outcomes	Measures used	Outcomes	Effect size
Ballard et al. [49]	Neuropsychiatric symptoms Agitation	NPI CMAI	Significant decrease in neuropsychiatric symptoms. No effect on agitation	Not reported
Brunelle-Hamann et al. [50]	Neuropsychiatric symptoms	NPI	Significant increase in aberrant motor behavior. Significant reduction in delusions for both groups	For aberrant motor behavior, Cohen's <i>d</i> = 1.38 For delusions, Cohen's <i>d</i> = 0.96
Chang et al. [51]	Overall BPSD, neuropsychiatric symptoms, agitation, anxiety	BEHAVE-AD CMAI C-CMAI NPI RAID	Five studies reduced overall BPSD. All studies reduced agitation; 2 reduced delusions, apathy, and anxiety; 1 reduced irritability, aberrant motor activity, and nighttime disturbances	The overall Hedges' <i>g</i> was -0.66 ( <i>R</i> = -1.18 to -0.18)

Table 1. (Continued)

Reference	Behavioral outcomes	Measures used	Outcomes	Effect size
D'Onofrio et al. [52]	Neuropsychiatric symptoms	Hamilton CMAI-SF NPI	Significant decrease in neuropsychiatric symptoms	Not reported
Forbes et al. [53•]	Agitation Neuropsychiatric symptoms	ABRS NPI CMAI CMAI	One study showed decrease in aberrant motor behavior and an increase in agitation/aggression. No studies found significant decreases in agitation.	Cohen's <i>d</i> ranged from -0.01 to 2.22
Fu et al. [54]	Agitation Neuropsychiatric symptoms	ABRS CMAI-SF	No significant effects on agitation.	Not reported
Lowery et al. [55]	Neuropsychiatric symptoms	NPI	No significant effect on neuropsychiatric symptoms	Not reported
Majić et al. [56•]	Agitation	CMAI	Levels of agitation and aggression remained constant.	Not reported
Moyle et al. [57]	Agitation	CMAI	Significant increase in agitation	$\eta^2$ ranged from 0.01 to 0.10
O'Connor et al. [58•]	Agitation	CMAI	No significant effects on agitation	Not reported
Pieper et al. [59]	Agitation Neuropsychiatric symptoms	CMAI NPI-NH	Significant decrease in agitation and neuropsychiatric symptoms	Not reported
Sánchez et al. [60]	Agitation Neuropsychiatric symptoms	CMAI NPI	Nonsignificant improvement in agitation Significant improvement in neuropsychiatric symptoms as compared to the activity group but not the control	For MSS and activity groups, significant improvement in aggressive behavior ( $\eta^2 = 0.300$ ) and total CMAI ( $\eta^2 = 0.277$ )
Van Hantsma et al. [61•]	Verbal and nonverbal behaviors; affect	MOSES	Both activity groups showed greater pleasure, alertness, engagement, positive touch, and positive verbal behavior versus usual care	Cohen's <i>d</i> ranged from 0.00 to 2.24.
Yang et al. [62]	Agitation	CMAI	Significant reduction in agitation, particularly when combined with acupressure	Not reported

Level I = evidence obtained from a systematic review or meta-analysis of all relevant RCTs; level II = RCT; level III-1: well-designed pseudo-RCT  
*SNF* skilled nursing facility, *ALF* assisted living facility, *RH* respite home, *CD* community-dwelling, *LOE* level of evidence, *BEHAVE-AD* Behavioral Pathology in Alzheimer's Disease Rating Scale, *CMAI* Cohen-Mansfield Agitation Inventory, *NPI* Neuropsychiatric Inventory, *RAID* Rating Anxiety in Dementia Scale, *ABRS* Agitated Behavior Rating Scale, *MOSES* Multidimensional Observation Scale for Elderly Subjects, *RCT* randomized controlled trial, *RCCT* randomized crossover trial, *RFCT* randomized factorial controlled trial, *CRCT* cluster-randomized controlled trial



**Table 2. Summary of intervention effectiveness**

Intervention type	Description of intervention	Number of studies ( <i>n</i> )	Percent of studies showing improvement, <i>n</i> (%)
Sensory			
Music therapy	Various group and individual music interventions	10	6 (60)
Multisensory stimulation	Snoezelen room	1	0 (0) <sup>a</sup>
Aromatherapy	Aromatic oil transdermally applied or diffused into the environment to cause a calming psychological and physiological response	3	1 (33)
Bright light therapy	Exposure to ambient light of various intensities and duration	5	1 (20)
Touch	May include massage, therapeutic touch, and craniosacral therapies	1	0 (0)
Cognitive			
Cognitive rehabilitation	Focuses on relearning or strengthening various skills or cognitive abilities	1	0 (0)
Cognitive stimulation	Cognitively stimulating or challenging activities	1	1 (100)
Exercise			
Physical exercise	Aimed at increasing physical activity	2	1 (50)
Multicomponent psychosocial			
Stepwise multidisciplinary intervention	Stepwise administration of intervention protocol	1	1 (100)
Tailored activities			
Individualized activity	Tailoring activity to preferences and physical/cognitive capabilities	1	1 (100)
Animal-assisted therapy			
Interaction with dog	Interaction with a trained animal facilitated by a human handler	1	0 (0)

<sup>a</sup>The MSS intervention was not significant compared to the control group but was significant compared to a one-to-one activity intervention

III-2 is a comparative study with concurrent controls, and level III-3 is a comparative study without concurrent controls. Level IV, the lowest level, is a case series with either posttest or pretest-posttest outcomes. As our analysis included meta-analyses and reviews as well as articles with original data, the highest level of evidence for an intervention in this review was level I. Only high-quality meta-analyses (level I) and randomized (level II) or pseudorandomized (level III-1) studies were included.

## Results

The initial search based on key words yielded 362 papers (Fig. 1). Through manual searches of these papers, an additional 16 were identified. Among these 378 papers, 14 met all of our inclusion criteria and were included in this review



(see Fig. 1). Of these 14 publications, two were reviews/meta-analyses and 12 were individual RCTs. Of the meta-analyses, 16 studies in total were represented. The details of the 14 publications are summarized in Table 1.

## Overview of findings

Overall, we find that ten different nonpharmacological interventions were systematically evaluated in the past 3 years. Although there is no consensus as to their classification [63], we grouped the interventions tested in these studies into six categories (sensory stimulation, cognitive, exercise, multicomponent, tailored activity, and animal-assisted therapy). Table 2 lists each intervention type, a description of what each entails, and a summary of effectiveness by intervention type.

## Sensory stimulation

A focus on sensory stimulation is primarily based on the premise that dementia appears to alter the way individuals see, hear, taste, feel, and smell as the disease progresses over and above changes due to the normal aging process [64, 65]. As cognitive function deteriorates [66], the context in which people live tends to be experienced at a sensory level. As such, the environment needs to be managed carefully to make it understandable and comfortable. In order to achieve this, persons with dementia, particularly in later stages, may require the simplification of environmental structures and stimulation [67]. This approach is supported by the Guideline on Supporting People with Dementia and Their Carers in Health and Social Care, developed by the National Institute for Health and Clinical Excellence and the Social Care Institute for Excellence (NICE-SCIE) [68] which highlighted that sensory stimulation may be the primary form of psychological intervention to reduce or prevent BPSD in persons with advanced dementia.

Sensory stimulation refers to any technique used to stimulate the senses with the goals of increasing alertness and reducing BPSD, and enhancing quality of life [69]. Interventions may be single sensory, which requires stimulation to only one sensory modality (e.g., touch), or multisensory, which requires stimulation of two or more senses [70].

In the past 3 years, seven studies have tested a sensory stimulation approach for persons with dementia with the goal of reducing and preventing BPSD. Sensory-oriented approaches that were tested included music ( $n = 1$  meta-analysis of 10 studies), multisensory stimulation (MSS;  $n = 1$ ), aromatherapy ( $n = 3$ ), bright light therapy ( $n = 1$ ), and touch therapies ( $n = 1$ ).

### *Music therapy*

In our review, one meta-analysis of ten RCTs [51] evaluated the effects of music interventions on the frequency of BPSD. Interventions were presented in both group [71–75] and individual [76–79] formats. Sample size ranged from 20 [73] to 100 participants [72]. Level of dementia spanned various stages including mild-moderate [71–75], moderate [72], moderate-severe [74, 77], and severe [73, 79]. The studies were primarily conducted within skilled nursing facilities [71–75, 78], while one study took place in assisted living [77]. No community-dwelling participants were included in

any of the studies reviewed. Average length of time of the music therapy interventions was 30 min [72–75, 78, 79], with a maximum of 65 min [77]. The total time period of the study ranged from 4 weeks [74] to 16 weeks [78]. Agitation was the BPSD most commonly targeted [71–75, 77, 78], followed by anxiety [71, 75, 76]. Other behaviors affected included delusions, apathy, irritability, aberrant motor activity, and nighttime disturbances [73, 78]. Overall, this meta-analysis found a significant reduction in the frequency of occurrences of dementia behaviors overall and that group music therapy exhibited a larger and more significant effect on BPSD than individual music therapy [51]. It is unclear whether it was the music itself, the opportunity for socialization, or both factors that are responsible for these treatment effects.

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### *Multisensory stimulation*

The MSS environment is typically a pleasant and relaxing room known as a Snoezelen room, which includes features that stimulate the primary senses except taste (e.g., fiber-optic cables, water columns, aromatherapy, different music/sounds, tactile objects, and screen projectors) [80]. Snoezelen is intended to stimulate the five senses without requiring the person with dementia to exert intellectual effort [81]. Stimuli used do not follow a specific sequence or pattern but rather are experienced moment by moment without relying on short-term memory to link them to previous events [81]. Only one pilot RCT was identified and this study involved 32 persons with severe dementia residing in a skilled nursing facility [60]. Participants were randomly assigned to one of three groups: MSS, one-to-one activity, and a usual care control group. The MSS entailed twice-weekly 30-min sessions in a Snoezelen room for a period of 16 weeks (32 sessions total). The activity group participated in a series of intellectually or physically demanding one-to-one activity sessions (e.g., playing a game) for the same duration as the MSS group. Control group members continued with their usual daily routine.

Findings indicate that MSS may be more effective than one-to-one activity sessions in reducing BPSD in patients with severe dementia, though the improvement with regard to agitation was comparable between the groups [60]. There were no significant differences between MSS and the control condition with regard to agitation or other BPSD.

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### *Aromatherapy*

Aromatherapy interventions were those that involved the absorption of essential oil via transdermal administration or inhalation in order to activate the autonomic nervous system and induce a reaction of the limbic system and hypothalamus [82]. The most frequently used oils in the treatment of BPSD such as agitation are lavender and Melissa oil (lemon balm). Though the majority of studies were published outside of our search parameters, we identified three studies: two RCTs [54, 62] tested a combined aromatherapy intervention compared to aromatherapy alone and a control group, and one randomized control crossover trial (RCCT) [58•] tested the effectiveness of lavender oil

alone compared to an inactive oil. The combined intervention in Fu et al. [54] involved lavender oil and hand massage applied in tandem, while the combined intervention utilized by Yang and colleagues [62] paired aromatherapy with acupuncture. Sample sizes across these three studies ranged from 64 [58•] to 186 [62]. Two of the studies primarily included persons with severe dementia [54, 58•], while the level of dementia was not specified in the third study [62]. All three studies were conducted within skilled nursing facilities. Duration of intervention varied considerably, from 1 min three times in 1 week with a 30-min observation period [58•], to 5 min twice per day for 10 days [54] to 15 min once per day, 5 days per week, for 4 weeks total [62]. Neither Fu et al. [54] nor O'Connor et al. [58•] found significant improvements in BPSD for persons who received aromatherapy as compared to those who did not. In contrast, Yang et al. [62] found that both aromatherapy combined with acupuncture and aromatherapy alone significantly decreased agitation as compared to a control group that did not receive any intervention, with the combination intervention (aromatherapy and acupuncture) having the most robust effect.

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### *Bright light therapy*

Bright light therapy (BLT) has primarily been tested as an intervention for circadian rhythm disorders or to reduce the incidence and duration of delirium in postoperative patients [83, 84]. The science behind this type of therapy is that dementia, particularly due to Alzheimer's disease (AD) pathology, exacerbates the physiological changes to circadian rhythms that occur with normal aging [85]. In persons with dementia, these changes may also be associated with such disturbances as rest-activity cycle disruptions and sundowning [86]. The neurobiological basis of these behavioral disorders is related to degeneration of the suprachiasmatic nucleus (SCN) of the hypothalamus that results in reduced expression of the vasopressin gene [86]. As with our search for aromatherapy, the majority of studies assessing bright light therapy as a behavioral intervention in dementia were published outside our 3-year window for inclusion. However, Forbes et al. [53•] conducted a systematic review examining the effectiveness of light therapy in improving cognition, activities of daily living (ADLs), sleep, challenging behaviors, and psychiatric symptoms in persons with dementia. Among the five included studies with BPSD as an outcome variable, sample size ranged from 13 [87] to 189 [88]. Median level of dementia was severe across studies, and all took place in skilled nursing facilities. Exposure protocol was variable and ranged from 10 days [89] to 3.5 years [88]. No two studies had the same method of bright light exposure. Agitation was the primary target for all studies, although aberrant motor behavior was also affected in one study [90].

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### *Touch*

Touch therapies can include craniosacral therapies, therapeutic touch, and massage. Only one trial met the search criteria of this review.

Moyle et al. [57] compared the effect of foot massage (intervention) and quiet presence (control) on agitation and mood in 55 long-term care residents with moderate to severe dementia. Sessions lasted approximately 10 min, 5 days per week, for 3 weeks. In both groups, participants' level of agitation increased, with a greater increase for the control group.

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## **Cognitive interventions**

Cognitive interventions involve three types: cognitive stimulation, cognitive training, and cognitive rehabilitation. There is also a significant overlap with what has been referred to as reality orientation, which emphasizes relearning orientation information, whereas cognitive interventions focus more on implicit information processing [52, 91]. Traditionally, cognition-focused interventions have been those that directly or indirectly target cognitive functioning as opposed to interventions that primarily address BPSD, emotions, or physical function [92].

### *Cognitive rehabilitation*

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In a crossover RCT, Brunelle-Hamann et al. [50] evaluated the impact of a cognitive rehabilitation program on 12 behavioral and psychological symptoms of dementia in 15 persons with mild to moderate Alzheimer's disease. A wait-list control group received the intervention following the study period. Results showed both negative and positive effects: there was a significant increase in aberrant motor behavior and a decrease in delusional symptoms for the cognitive rehabilitation group as compared to the control group.

### *Cognitive stimulation*

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In a pilot single-blind randomized controlled clinical trial, D'Onofrio et al. [52] investigated the efficacy of an integrated treatment of rivastigmine transdermal patch (RTP) and cognitive stimulation (CS) as compared to RTP alone in 90 community-dwelling persons with Alzheimer's disease. Overall, the authors concluded that the integrated treatment of RTP + CS in AD patients for 6 months significantly improved cognition, depressive and neuropsychiatric symptoms, functional status, and mortality risk in comparison with RTP treatment alone [52].

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## **Physical exercise**

As part of the Well-Being and Health for People with Dementia (WHELD) program, Ballard et al. [49] conducted a cluster-randomized factorial controlled trial with two replications for 195 persons with dementia residing in 16 UK nursing homes. Results showed that a personalized exercise plan significantly improved neuropsychiatric symptoms as compared to a social interaction intervention and antipsychotic review. In contrast, Lowery et al. [55] conducted a pragmatic, randomized, controlled, single-blind, parallel-group trial of a dyadic exercise regimen (i.e., tailored walking) versus treatment as usual for 116 community-dwelling individuals with dementia and their caregivers. These

authors found no significant difference between the groups regarding mean NPI score at week 12 [55].

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### Tailored activities

Existing research finds that engagement in meaningful activity can increase positive emotions, improve performance in activities of daily living, improve quality of life and well-being, foster positive attitudes toward caregivers, and decrease behavioral symptoms [93, 94]. Furthermore, tailoring activities to the interests and abilities of persons with dementia may be particularly beneficial [29•, 95, 96].

The trial included in our review [61•] evaluated the utility of a preference-based activity intervention on improving affect and behavioral engagement in 188 nursing home residents with dementia. Residents were randomly assigned either to usual care or to one of two experimental conditions in which certified nursing assistants (CNAs) led one-on-one activities. In the first experimental group, the CNA led a standard activity, which involved looking through a magazine with the participant and discussing the content. In the second group, the CNA led an activity tailored to the individual's current preferences and abilities. Results showed similar outcomes among the standard activity and tailored activity groups in terms of increased pleasure, alertness, engagement, positive touch, and less general restlessness as compared to persons receiving usual care, with no significant differences found between the experimental groups. However, the standard activity group exhibited more uncooperativeness and more negative verbal behaviors as compared to the tailored activity or usual care groups [61•].

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### Multicomponent psychosocial interventions

Multicomponent interventions were those that utilized at least two interventions in combination, with at least one of them being nonpharmacological. Pieper et al. [59] conducted a single-blind, cluster, RCT of a stepwise multicomponent intervention (STA OP!) to assess its effectiveness in reducing challenging behaviors and depression in nursing home residents with advanced dementia. The intervention was delivered in a stepwise fashion and entailed the following: a physical needs assessment, an affective needs assessment, a trial of nonpharmacological comfort interventions, a trial of analgesics if nonpharmacological approaches were ineffective, and consultation with other health-care professionals or practitioners or a trial of psychotropic drugs. Staff in the control group received training on pain, dementia management, and general nursing skills, without the stepwise component. Results showed a significant effect of the intervention on agitation and neuropsychiatric symptoms overall [59].

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### Animal-assisted therapy

Animal-assisted therapy (AAT) is traditionally used to promote social interactions for persons with dementia through interaction with a trained animal facilitated by a human handler. In one study, Majić et al. [56•] investigated the efficacy of AAT compared to treatment as usual using a matched case-control design with within-participant repeated measures. In the control group,

symptoms of agitation/aggression and depression significantly increased over 10 weeks, whereas the frequency and severity of symptoms of agitation/aggression and depression were unchanged for persons receiving AAT [56•].

## Discussion

BPSD are universal and occur across disease trajectory regardless of etiology [97, 98]. They can be disturbing to persons with dementia as well as caregivers. A growing body of evidence suggests that psychosocial and environmental approaches may be efficacious and safe. While there have been several systematic reviews of nonpharmacological interventions for dementia behaviors previously, given the importance of deriving treatment options and the continued growth of research in this area, our review presents the research published within the past 3 years.

The studies discussed in this review show considerable heterogeneity with regard to intervention protocols, assessment tools, and evaluation of outcome(s). We identified six categories or types of interventions evaluated over the past 3 years. With regard to sensory-oriented interventions, numerous approaches have been tested, including music, multisensory stimulation, aromatherapy, bright light therapy, movement, and touch therapies. As to music therapy, previous systematic reviews reported inconsistent outcomes, with some showing reductions in BPSD [33–35], and others not [37, 99]. The meta-analysis in our review [51], however, found a significant reduction in dementia behaviors with music therapy. The authors recommended that individual music therapy be provided once per week to persons with cognitive impairment, and group music therapy be provided several times a week to individuals with disruptive behaviors to reduce anxiety. The results indicated that when residents in nursing homes attended music therapy less than once a week, the therapy provided was less effective at managing behaviors [51].

Previous reviews and studies reported inconsistent findings but some positive effects of MSS on BPSD. However, there has been no consistent evidence to demonstrate significant or long-term reductions in symptoms [33, 34, 37, 100]. Our review similarly did not find compelling evidence to support this intervention, as MSS appears preferable to one-on-one activity sessions but not a control condition [60].

The bulk of the literature detailing the clinical benefits of aromatherapy in dementia was published outside of the search parameters of this review, and the evidence for this intervention has thus far proven inconclusive [34, 35, 37, 38, 101]. Our review findings regarding this intervention are inconclusive as well; one study suggests it may be beneficial but only in combination with other strategies.

Findings from previous reviews indicate that bright light therapy appears to be ineffective at best [33, 37, 102] and, at worst, may actually increase or exacerbate dementia behaviors [38, 103]. Our review similarly suggests that bright light therapy appears to be ineffective in managing BPSD.

There is still much to learn regarding the impact of cognitive interventions on BPSD of dementia, as most studies have focused on improving global or specific cognitive functions versus BPSD [92]. Previous reviews including a Cochrane report [104] indicated that these types of interventions do not appear to have an impact on BPSD. In our review, two studies met the search criteria and examined the relationship between a cognitive intervention and behavioral symptoms.



Cognitive rehabilitation appeared to have discrepant effects on various types of behavioral symptoms, as it increased aberrant motor behavior, a negative effect, yet decreased delusions, a positive effect [50]. Cognitive stimulation appears promising only when combined with rivastigmine [52].

At present, there are few robust clinical trials examining the effects of physical exercise on BPSD and conflicting results from meta-analyses [102, 105]. Previous research yielded insufficient support for physical exercise specific to its effects on BPSD [30, 37, 102]. Similarly, our review includes two RCTs [49, 55], one with positive and one with negative outcomes; thus, support for physical exercise as an intervention for BPSD remains inconclusive.

The literature contains many anecdotal reports of positive results from AAT in persons with dementia as well as some published findings from controlled studies [106]. A prior systematic review found AAT to have beneficial effects on BPSD [33]. In contrast, the study included in our review [106] found that BPSD did not improve as a result of AAT, but remained constant in frequency and severity while BPSD exhibited by the control group worsened. As behaviors did not worsen, this could be interpreted as a positive outcome. Consequently, AAT continues to show some promise but more high level rigorous studies need to be conducted with positive results in order for this type of intervention to be recommended as a nonpharmacological strategy to decrease dementia behaviors.

Increasing evidence suggests that activities tailored to an individual's preferences and abilities are beneficial and result in reduced behavioral symptoms [29•, 95, 96]. The recent study included in our review [61•] found similar outcomes with regard to the positive effects on affect and behavior of standard activities and tailored activities. However, the tailored activities did not result in any negative outcomes whereas the standard activity was also associated with anger, negative verbal behaviors, and uncooperative behaviors. Overall, this study was consistent with the findings in the literature that tailoring activities has positive benefits. Similarly, positive findings have been reported for a single arm study that introduced the use of tailored activities as a therapeutic modality in the hospital setting [107]. Although this study was not reviewed here as it did not fit our review criteria (e.g., not a RCT), it does add incrementally to a growing and strong body of evidence showing the benefits of activity that enhances engagement in persons with dementia [108]. This is an area that should be prioritized for research investments.

One study employed a stepwise, multicomponent approach including a trial of nonpharmacological interventions [59]. Results showed significant effects on BPSD as compared to the control group, though it is unclear whether it was the bundled intervention as a whole that resulted in a decrease of BPSD or if one of the discrete components was the key ingredient.

Given the recent proliferation of research on nonpharmacological interventions for dementia behaviors, it is imperative that the systematic synthesis of the evidence be ongoing, particularly as high-quality research studies are published. For example, the studies included in our review all used a randomized controlled design, the lack of which has been a critique of previous research in this area. With adequate control groups, we now find differential effects still due to lack of power, small sample sizes, lack of diversity in samples (most samples were Caucasian), and lack of attention to fidelity. Maintaining up-to-date syntheses that integrate high-quality studies into our evidence base will ensure optimum approaches to treatment and provide guidance as to which nonpharmacological approaches and



for which behaviors should be integrated into clinical practice.

Of note, we find that the research rigor in this area is advancing but only partially. One concern is that nonpharmacological approaches previously shown to be effective do not appear to have undergone further replication, testing, and implementation, at least over the past 3 years that we examined in our review. For example, prior research showed that the physical and social environment can be impacted and in turn can improve behavioral outcomes [33, 96, 109]. Nevertheless, no studies in the last 3 years have been published to further this line of important work. Research is still needed to more fully understand these approaches and specifically to determine their effectiveness with diverse populations, and to systematically link participant characteristics, specific behavioral symptoms with particular intervention strategies. Similarly, implementation studies of previously proven interventions to identify strategies for their integration in practice settings are critically needed [110].

Another concern is that methodological limitations continue to persist even in these most recent studies. For example, most studies were conducted in nursing homes versus the home, whereas the latter is where most persons with dementia live and thus where many behavioral symptoms are experienced. In addition, numerous studies that were not included in our review because they did not employ a randomized controlled design have reported positive outcomes for BPSD from nonpharmacological approaches, supporting a signal and that more research needs to be pursued [111, 112]. However, the lack of diversity among study samples continues to be alarming; as the use of nonpharmacological strategies must be tailored to particular contexts including the cultural values and beliefs of families, involving more diverse samples in this field of research is an imperative.

## Conclusion

We conclude that the results in the recent literature concerning the efficacy of psychosocial and environmental treatment approaches to behavioral symptoms in dementia continue to be promising yet the results are also mixed. Despite their outcomes, these studies as a whole illustrate that it is possible to design randomized controlled trials to evaluate nonpharmacological interventions. From our review and in keeping with previous reviews, several nonpharmacological approaches emerge as important for continued research and possibly use in clinical settings. Music therapy and tailored activities appear particularly promising, and there is some evidence to suggest that MSS and AAT are worthy of further careful evaluation. In contrast, approaches such as bright light therapy and aromatherapy have consistently been shown to be ineffective. Given the limited research funding allocated to the study of BPSD and their treatment, we recommend that studies of interventions with clear or somewhat clear indications of efficacy be pursued.

In summary, the studies we reviewed do not report adverse or negative side effects. Furthermore, some although not all nonpharmacological strategies appear to positively affect behaviors. As such, we suggest that some strategies can be used now in the clinical context while more evaluation is underway in different contexts. For example, multicomponent interventions that involve providing caregivers education and support, instruction in effective

communication strategies and ways to simplify the environment, along with the purposeful tailoring and use of meaningful activities, are all examples of approaches that can be used now and provided to families to help them prevent and/or manage behavioral symptoms at home [113].

## Compliance with Ethical Standards

### Conflict of Interest

Dr. Natalie G. Regier declares that she has no conflict of interest. Dr. Laura N. Gitlin declares that she has no conflict of interest.

### Human and Animal Rights and Informed Consent

There are no sources of funding to report. This article does not contain any studies with human or animal subjects performed by any of the authors.

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