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Non-Pharmacological Interventions in the Management of Dementia-Related Psychosis: A Systematic Review and Meta-Analysis

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ABSTRACT

Objective: As populations age globally, there is an increasing prevalence of dementia, with an estimated 153 million living with dementia by 2050. Up to 70% of people with dementia experience dementia-related psychosis (D-RP). Antipsychotic medications are associated with many adverse effects in older people. This review aims to evaluate the evidence of non-pharmacological interventions in managing D-RP.

Method: The search of Medline, EMBASE, Web of Science, CINAHL, PsycINFO, and Cochrane included randomised controlled trials that evaluated non-pharmacological interventions. Data extraction and assessment of quality were assessed independently by two researchers. Heterogenous interventions were pooled using meta-analysis.

Results: A total of 18 articles (n = 2040 participants) were included and categorised into: sensory-, activity-, cognitive- and multi-component-orientated. Meta-analyses showed no significant impact in reducing hallucinations or delusions but person-centred care, cognitive rehabilitation, music therapy, and robot pets showed promise in single studies.

Conclusions and Implications: Future interventions should be developed and evaluated with a specific focus on D-RP as this was not the aim for many of the included articles.

1 | Background

Advancements in medicine and public health have contributed to the global increase in life expectancy, reaching 72.7 years in 2019 and is projected to rise to 82 years by 2075 [1]. Correspondingly, the burden of dementia, which primarily affects older adults, is continuously increasing [2] and by 2050, 153 million people worldwide are expected to be living with dementia [3]. Although the characteristic symptom of dementia is cognitive deterioration, neuropsychiatric symptoms are common, debilitating, and difficult to treat. Depending on the dementia subtype and progression of the disease, it is estimated 20%–70% experience dementia-related psychosis (D-RP). Psychosis manifests primarily through hallucinations and delusions. Hallucinations occur predominantly in visual and auditory sensory modalities and are defined as a lived

Summary

- There is limited evidence to suggest non-pharmacological interventions effectively manage psychosis in dementia.
- There may be preliminary evidence for some efficacious interventions, such as music, cognitive therapy, and person-centred care.
- More research is needed to understand the efficacy of interventions in the management of hallucinations and delusions.
- Interventions need to be developed that specifically target hallucinations and delusions, not wider behavioural and psychological symptoms of dementia.

experience in the absence of an external, sensory stimulus [4]. Delusions are characterised into two main types: paranoid or misidentification [5] and defined as fixed beliefs that do not change despite conflicting evidence [4]. The aetiology and neurobiological mechanisms of psychosis in dementia remains unknown [6], however evidence suggests it may be due to changes in dopaminergic, serotonergic, glutamatergic, and gamma-aminobutyric acid (GABA)-ergic neurotransmission [7]. In particular, delusions and hallucinations may be caused by excess dopamine signalling in the mesolimbic pathway [8], which plays a key role in motivated behaviours, affective functions, cognitive processes, and reward and learning [9].

D-RP has many detrimental effects, including decreased quality of life, increased carer burden, increased rapid cognitive decline, hospitalisation, and earlier care/nursing home admission [10, 11], all of which come at a considerable cost to health care systems.

Atypical antipsychotic medications, serotonin-dopamine antagonists, differ from the first-generation typical antipsychotics, which are dopamine antagonists [12] and are used to treat hallucinations and delusions. Whilst their relative efficacy remains uncertain, atypical antipsychotics may cause fewer side effects [13]. These medications, such as risperidone, are prescribed off-label in people with dementia, and are associated with sedation, extrapyramidal effects, worsening cognition, strokes, and increased mortality [14–17]. Regulatory bodies, including the US Food and Drug Administration (FDA), the European Medicines Agency, and the UK Medicines and Healthcare Products Regulatory Agency (MHRA), have issued warnings regarding antipsychotic use in dementia [18]. Currently, there is no FDA-approved drug for D-RP and the MHRA has only approved one antipsychotic for agitation, risperidone, for short term use (up to 6 weeks) [19]. When prescribed off-label, NICE guidelines state patients should be reassessed every 6 weeks and medication stopped if there is no clear benefit [20, 21]. Despite these concerns, there remains a high-prescribing rate for D-RP [21].

In the absence of a cure for dementia, research and care aims to enhance the quality of life and manage symptoms effectively. Non-pharmacological interventions present a potential solution. While numerous systematic reviews exist and show efficacy for non-pharmacological interventions in the management of behavioural and psychological symptoms of dementia (BPSD) and overall neuropsychiatric symptoms [22–25], none have specifically focused on the symptoms of D-RP. Given the heterogeneity of neuropsychiatric symptoms in dementia, individual symptom-focused reviews are essential as successful non-pharmacological strategies may differ between the diverse symptoms [25].

The primary aim of this systematic review was to evaluate randomised controlled trials of non-pharmacological interventions in reducing the incidence, frequency, and severity of D-RP symptoms in people with dementia in community, residential, and nursing home settings.

1.1 | Secondary Aims

1. To identify the types and characteristics of non-pharmacological interventions used in the management of D-RP.
2. To evaluate the effect of non-pharmacological interventions on patient's quality of life.
3. To describe the cost-effectiveness and safety of the interventions.

2 | Materials and Methods

This systematic review was conducted following JBI methodology [26] and is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist [27]. We registered our protocol with Prospero (ID: CRD42023394750).

2.1 | Search Strategy and Selection Criteria

Search terms were developed from existing literature, discussions with an information specialist based in the UCL library, and pilot searches in Medline. Medline, EMBASE, CINAHL, Web of Science, PsycINFO, and Cochrane were searched from inception to 22 March 2023. The search strategy included key words and subject heading regarding non-pharmacological intervention types, different subtypes of dementia (e.g., Alzheimer's disease), DR-P terms and trials terms (Supporting Information S1: Appendix 1). Articles were also identified via hand searching the reference lists of included articles and citation tracking. Sixty-three authors were contacted for further information and missing data, and fourteen (22%) provided additional information.

2.2 | Eligibility Criteria

We included studies in any language, which met the following criteria (Supporting Information S1: Appendix 2):

1. The majority of participants (at least 80% of the sample) had a diagnosis of any subtype of dementia, or probable dementia.

2. The study was a randomised controlled trial (RCT) evaluating any non-pharmacological intervention.
3. The comparator was either no intervention, usual care, or active intervention (medication or non-pharmacological intervention).
4. Outcomes were reported as changes in psychosis using a validated scale such as the Neuropsychiatric Inventory (NPI).
5. The context was in the community, care home (nursing or residential) or living at home.

We excluded studies that reported psychosis but the scores at baseline were 0, or if the intervention was mixed and there was no separate analysis of the non-pharmacological intervention (e.g., medication + non-pharmacological intervention vs. no intervention). We also excluded inpatient hospital settings as these characteristics differ from community settings.

2.3 | Study Screening

All articles were exported to Mendeley, de-duplicated, and transferred to Rayyan [28] for screening. Titles, abstracts, and full texts were independently reviewed by two researchers (A.B. and T.R. or F.M.). Discrepancies were discussed with the wider team and inclusion criteria were refined for clarity as needed. A data extraction tool in Microsoft Excel was developed, tested by two researchers (A.B. and F.M.), and refined after discussion with an additional reviewer (R.F.). The remaining included sources were extracted by two independent reviewers (A.B. and T.R./F.M.).

2.4 | Risk of Bias

Two researchers (A.B. and T.R.) independently assessed all articles and assigned a score using the revised Cochrane risk-of-bias tool for randomised trials (RoB 2) [29]. Domains cover risks of bias from: the randomisation process (D1), deviations from the intended intervention (D2), missing outcome data (D3), measurement of the outcome (D4) and selection of reported results (D5) [29]. Each study was assigned an overall score of 'low' (low risk across all domains), 'some concerns' (some concerns in a small number of domains), or 'high' risk of bias (high risk in one or more domains or some concerns across most domains). Disagreements were resolved through discussion with a third reviewer (R.F.) where needed.

2.5 | Statistical Analysis

We planned to undertake two separate meta-analyses for outcomes related to delusions and hallucinations, where outcome data and interventions were sufficiently homogeneous, with subgroup analyses according to intervention type. A random-effects model was used to account for heterogeneity, which was assessed using I^2 statistic. As all studies utilised the same outcome measure, we synthesised data using mean difference (MD) in post-intervention values. Standard deviations (SDs) were calculated from standard errors and confidence intervals where needed. Studies for which SDs could not be calculated, were without post-intervention scores, or only reported change from baseline scores, were synthesised narratively.

3 | Results

3.1 | Study Selection

A total of 6637 studies were identified after searching electronic databases which included 18 relevant RCTs in the final analysis (Figure 1).

3.2 | Study Characteristics

The 18 included studies were conducted between 2007 and 2023 in Italy ($n = 4$), France ($n = 2$), The Netherlands ($n = 2$), The UK ($n = 2$), Norway ($n = 2$), Brazil ($n = 2$), Canada ($n = 1$), Finland ($n = 1$), USA ($n = 1$) and Hong Kong ($n = 1$) (Table 1).

3.3 | Participant Characteristics

The mean age of people with dementia reported varied from 73.2 to 88.34 years, and were diagnosed with a variety of dementia subtypes, including Alzheimer's disease (AD) ($n = 5$), vascular dementia (VD), mixed dementia, dementia with Lewy Bodies, Frontotemporal dementia (FTD), Parkinson's disease dementia (PDD) ($n = 1$), 'other' dementia or cognitive disorders or a mixture ($n = 12$). Baseline psychosis scores (hallucination and delusions combined) ranged from 0.44 to 6.68. The sample sizes ranged from 15 to 624 participants, and the total number of participants across the 18 studies is 2040.

3.4 | Nature of Interventions

The intervention recipients varied, including people with dementia ($n = 7$), nursing/care home staff ($n = 5$) and people with dementia and their caregivers ($n = 6$). They were delivered by the researchers ($n = 2$), multi-disciplinary team (MDT) ($n = 2$), nursing home physicians ($n = 1$), occupational therapists ($n = 2$), trained operators for the intervention ($n = 4$), psychologist ($n = 1$), music therapists ($n = 2$), psychotherapist ($n = 1$), physiotherapist ($n = 1$) and nursing/care home staff ($n = 2$). The intervention groups included a teaching programme ($n = 1$), psychotherapeutic intervention ($n = 1$), robot pets ($n = 2$), dementia care mapping/'VIPS' (Valuing people with dementia, Individualised care, understanding from patient's Perspective, Social environment) practice model ($n = 1$), mindfulness ($n = 1$), cognitive rehabilitation ($n = 1$), music therapy ($n = 2$), exercise ($n = 1$), life story book ($n = 1$), bright light therapy ($n = 1$), cognitive stimulation therapy ($n = 1$), aromatherapy ($n = 1$), transcranial direct current stimulation (tDCS) ($n = 1$), multi-component intervention ($n = 1$) and tailored activity programme ($n = 2$) (see Table 1 for details).

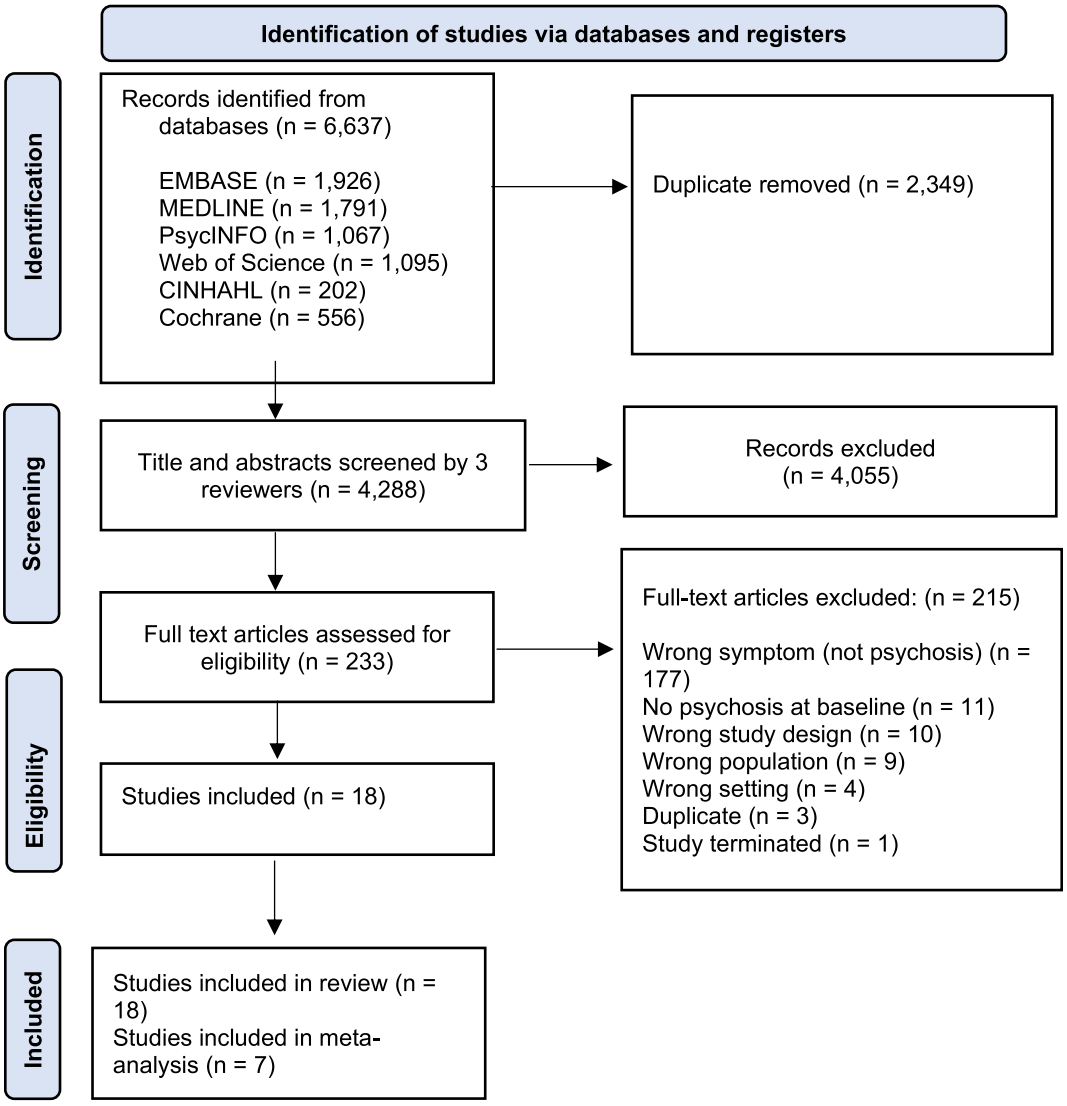

FIGURE 1 | PRISMA study flow chart.

The control groups also varied, from treatment as usual or conventional therapy ($n = 4$), waitlist control ($n = 4$), education or other entertainment activities ($n = 6$), memantine ($n = 1$), usual indoor light ($n = 1$), sunflower oil ($n = 1$) and placebo tDCS ($n = 1$). The interventions were delivered in the participants' home ($n = 3$), in a nursing/care home ($n = 10$), in an outpatient setting ($n = 4$), or a mixture ($n = 1$), with the frequency ranging from daily to weekly sessions and a length of 30 min to 4 h. The total duration ranged from 4 days to 1 year. Interventions were grouped into four major categories (see Table 2).

3.5 | Risk of Bias

Thirteen studies had an overall 'low risk of bias', and five studies scored 'some concern' or 'high risk'. This was mostly due to not explicitly stating that the allocation sequence was concealed prior to group allocation (Supporting Information S1: Appendix 3).

3.6 | Meta-Analysis of Eligible Studies

Seven studies were eligible for inclusion in the meta-analysis. The primary outcome measure across all studies was the Neuropsychiatric Inventory (NPI).

4 | Sensory-Orientated Interventions

4.1 | Robot Pet Therapy

Two studies [32, 33] evaluating the impact of robot pets on participants' NPI delusion and hallucination scores were meta-analysed (Figures 2 and 3). Bradwell et al. [32] ($n = 63$, 3 months) compared robot pets versus control with daily sessions of interaction, and Soler et al. [33] ($n = 211$, 3 months) compared humanoid robots, pet robots, and a real animal versus control with sessions 2 days a week. Bradwell et al. [32] report a significant reduction in delusions post intervention, and an increase in the control group. The robot pet [33] produced no significant

TABLE 1 | General characteristics of the included articles.

Author (year), country	Setting	Dementia diagnosis and severity	Sample size		Demographic	Intervention	Who was intervention for	Intervention provider	Control group	Duration/ length and frequency of intervention
			Intervention group	Control group	Age: *M* (SD)					
Leone et al. (2012) [30], France	Nursing home	Any subtype of dementia MMSE less than 24	119	111	Age: 88.34 (6.3) Female: 79.5% Education: Not reported Ethnicity: Not reported	Teaching programme	Nursing home staff	Two psychologists conducted training	TAU	2 h training including description of study. Then weekly 4 h training for 1 month
Bakker et al. (2011) [31], Netherlands	Nursing home	AD (18.5%), VD (23.5%) other dementia (16.5%) other cognitive disorders (32.1%), other 6.2% N/A MMSE score	81	87	Age: 80.65 (6.6) Female: 64.4% Education level low: 68.1% Ethnicity: Not reported	Psychotherapeutic intervention	People with dementia and their caregivers	A wide variety of staff in the multidisciplinary IRR team	Multi-disciplinary care support at home or in care home	13 weeks
Bradwell et al. (2022) [32], The UK	Care home	All types of dementia Dementia Severity Scale average dementia score was 32.11 (SD 10.52)	26	37	Age: 87.21 (7.42) Female: 73.4% Education: Not reported Ethnicity: Not reported	Cat and dog robots	People with dementia	Researchers informed care home staff of prior research and examples and ideas, and then professional judgement was left to the staff about robot use	Nothing for the first 4 months, after following ups they received the robots too	4 months
Soler et al. (2015) [33], France	Nursing home	84.2% Alzheimer disease, 10.9% mixed dementia, 3% Parkinson's disease dementia, 1% dementia with Lewy bodies, 1% Frontotemporal dementia Moderate to severe MMSE: Range 3.20–3.64	PHASE 1: PARO = 33/ NAP = 30. PHASE 2: PARO = 42/ DOG = 36	PHASE 1: 38. PHASE 2: 32	Age: 77.9 (4.75) Female: 50% Education: Not reported Ethnicity: Not reported	Robot pets, human robot and a real dog	People with dementia	The therapists were certified occupational and physical therapists, and neuropsychologists employed by the ACRSF	Conventional therapy	Therapy sessions 2 days a week for 3 months

(Continues)

TABLE 1 | (Continued)

Author (year), country	Setting	Dementia diagnosis and severity	Sample size		Demographic	Intervention	Who was intervention for	Intervention provider	Control group	Duration/ length and frequency of intervention
			Intervention group	Control group	Age: *M* (SD)					
Rokstad et al. (2013) [34], Norway	Nursing home	All subtypes of dementia. All severities CDR 12.8 ± 4.1	DCM $n = 158$ VPM $n = 138$	150	Age: 85.7 (8.3) Female: 71.8% Education: Not reported Ethnicity: Not reported	Dementia Care Mapping and 'VIPS' Practice Model ((V) valuing people with dementia, Individualised care (I) and understanding the world from the patient's perspective (P) and providing a social environment that supports the needs of the patient (S))	Nursing home staff	DCM and VPM trainers	5 DVDs with lectures (30 min each) about dementia	DCM: 3-h lectures and courses VPM: Weekly consensus meeting in the nursing home ward of 45–60 min
Giulietti, Spatuzzi, and Fabbietti (2023) [35], Italy	Living at home	Diagnosis of Alzheimer's dementia Mild dementia MMSE score range 18–27	22	22	Age: 82.8 (4.9) Female: 70.5% Low education: 64.9% Ethnicity: Not reported	Mindfulness based intervention	People with dementia	Single psychotherapist with specific training in mindfulness and 10 years of experience in meditation practice	Left without any intervention but assigned to cognitive training groups at the end of the study after 6 months	One 1-h session each week for 6 months
Brunelle et al. (2015) [36], Canada	40% lived at home, 60% in 'homes for the elderly'	Alzheimer's dementia Mild-moderate average MMSE score 21.60 (2.06)	7	8	Age: 80.47 (5.62) Female: 73.30% Education in years: 11.00 (SD 3.14) Ethnicity: Not reported	Cognitive rehabilitation	People with dementia and their caregivers	A 'trainer'	Received nothing for first 13 weeks then received intervention second	The 45–60-min session took place at each participant's home, twice a week for 4 week. The intervention delivery started between week 2 and week 5
Giovagnoli et al. (2018) [37], Italy	Outpatient setting	Probable Alzheimer's dementia MMSE scoring to show cognitive decline in the patient from pre-screening to BL	23	22	Age 73.2 (SD not reported) Female: 69% Education: Not reported Ethnicity: Not reported	Active music therapy (AMT) and memantine	People with dementia	Lead by a music therapist. Neuropsychologist evaluated patients at BL week 12 and 24 blindly	Memantine 20 mg added to their AchEI	AMT included twice weekly sessions, lasting 40 min for 24 weeks. Memantine 20 mg/ day was added to AchEI

(Continues)

TABLE 1 | (Continued)

Author (year), country	Setting	Dementia diagnosis and severity	Sample size		Demographic	Intervention	Who was intervention for	Intervention provider	Control group	Duration/ length and frequency of intervention
			Intervention group	Control group	Age: *M* (SD)					
Raglio et al. (2010) [38], Italy	Nursing home	Alzheimer's dementia, vascular, mixed MMSE score ≤18	30	30	Age: 85 (6.7) Female: 91.7% Education in years: 6.5 (3.6) Ethnicity: Not reported	Music therapy	People with dementia	Music therapist	Standard care that is educational and entertainment activities, such as reading a newspaper	3 × a week for 6 months (12 weeks). Each session was 30 min
Öhman et al. (2017) [39], Finland	Home-living with spouse	Alzheimer's dementia MMSE: 18.4 (6.2)	120: (Home exercise group $n = 63$, group exercise group $n = 57$)	59	Age: 77.8 (5.3) Female: 38.5% Education <8 years: 38.1% Ethnicity: Not reported	Exercise (home based or group in day centres)	People with dementia and their carers	Both intervention groups exercised under supervision of a physiotherapist	Normal community care	6 Months to 1 h twice a week for 12 months
Elfrink et al. (2021) [40], The Netherlands	Home	Very mild dementia 0.5–1 score of CDR	20	19	Age: 80 (9.4) Female: 55% Low education level: 50% Ethnicity: Born in the Netherlands 39 (93%), born abroad 3 (7%) 55.8%	Online Life Story Book (approach in reminiscence)	People with dementia and their informal carers	Trained volunteers supported the PwD and their caregivers in making the OLSB. There were 13 volunteers who received 4 h on training. The training was led by the researchers and a senior psychologist	Dyads received usual care and were offered to create an OLSb after a period of 6 months	Visits from volunteers 5 times in a 8–10 week period to use the application and create their Life Story Book
Dowling et al. (2007) [41], USA	Nursing home	Alzheimer's disease MMSE of at least 7	70: (morning light $n = 29$, afternoon light $n = 24$)	17	Age: 84 (10) Female: 81% Education: Not reported Ethnicity: 80.4% Caucasian, 13.0% African American, 4.4% Latino, and 2.2% Asian 81.4%	Bright light exposure	People with dementia	Nursing home staff to help correct exposure of light to IG pts (more than 2500 lux)	Usual indoor light (150–200 lux) and participated in their regularly scheduled activities in the usual location	10 weeks, 1 h 5 days a week
Capotosto et al. (2017) [42], Italy	Residential care home	Alzheimer's dementia, vascular or mixed At least score of 14 MMSE	20	19	Age: 87.39 (5.35) Female: 69.1% Education in years: 6.0 (2.8) Ethnicity: Not reported	Cognitive stimulation therapy	People with dementia	Two trained operators acted as facilitators	'Comparable treatment to the treatment group'	Held for 7 weeks, 2 × 45-min sessions held weekly

(Continues)

TABLE 1 | (Continued)

Author (year), country	Setting	Dementia diagnosis and severity	Sample size		Demographic	Intervention	Who was intervention for	Intervention provider	Control group	Duration/ length and frequency of intervention
			Intervention group	Control group	Age: *M* (SD)					
Lin et al. (2007) [43], Hong Kong	'Care and attention' homes	AD: 44 (62.9%), VD: 21 (30%) 'other' dementia: 5 (7.1%) Mean CMMSE score was 7.89	35	35	Age: 78.29 (SD not reported) Female: 58.6% Education: Not reported Ethnicity: Not reported	Aromatherapy	People with dementia	Care home staff	Sunflower oil in the aroma diffuser	1 h every night for 3 weeks, then a 2 weeks wash out, and another 3 weeks
Elder et al. (2016) [44], The UK	Living at home	PDD or LBD	21	19	Age: 75.1 (7.93) Female: 25.3% Education: Not reported Ethnicity: Not reported	Transcranial direct current stimulation (tDCS)	People with dementia	Stimulation was administered by a trained technician or research nurse, who were blinded to the stimulation condition	Had a placebo tDCS	Two 20-min tDCS sessions with a 30-min break over 4 days
Lichwarck et al. (2018) [45], Norway	Nursing home	Probable dementia (89.1% had dementia) Clinical Dementia Rating (CDR) score of 1 or more	17 NH and 104 patients	CG = 16 NH and 125 patients	Age: 83.15 (9.4) Female: 60.35% Education: Not reported Ethnicity: Not reported	Multi-component intervention based on cognitive behaviour therapy and person centred care	Nursing home staff	Staff of nursing home and nursing home physicians perform examinations of patients, registered nursing home nurses carry out reflections based on cognitive therapeutic principles	Brief education-only intervention	8 weeks involving lectures for up to 3 h
De Oliveira (2018) [46], Brazil	Outpatient-memory clinic	19 (90.5%) had AD, and 2 (9.5%) had 'other' dementia Average MMSE score 15.30 (3.30)	11	10	Age: 79 (5.71) Female: 71.4% Education: School until 8 years: 12 (61.9%) Ethnicity: Not reported	Tailored activity program-OUT patient versions	People with dementia and their carers	3 OTs received 30 h of training in the TAP protocol. The occupational therapist delivers the sessions	Regular care and psychoeducation	8 weekly sessions (last average 1 h each) over 3 months
Oliveira (2021) [47], Brazil	Outpatient clinic in a hospital	Probable AD 49 (90.7%), mixed dementia 5 (9.2%) Moderate-to-severe	28	26	Age: 77.4 (7.5) Female: 66.7% Education: Level less than 4 years: 14 (25.9%) Ethnicity: Not reported	Tailored activity program-OUT patient versions	People with dementia and their carers	3 OTs received 30 h of training in the TAP protocol. The occupational therapist delivers the sessions	Regular care and psychoeducation	8 weekly sessions (last average 1 h each) over 3 months

result, whereas the humanoid robot not included in the meta-analysis to align with Bradwell et al.'s [32] analysis, increased delusions in the intervention group. For hallucinations, Bradwell et al. [32] found no significant reduction, while Soler et al. [33] reported increased hallucinations post-intervention. The meta-analysis indicated a nonsignificant overall effect on delusion reduction (MD = −0.50, 95% CI: −1.89 to 0.88, $p = 0.47$; Figure 2), with a 74% I^2 statistic, signifying high heterogeneity or hallucinations (MD = 0.04, 95% CI: −1.40 to 1.32, $p = 0.95$, $I^2 = 80\%$).

TABLE 2 | Summary of four intervention categories for non-pharmacological interventions including the number of studies.

Category	Details
Sensory-orientated	Music therapy ($n = 2$)
	Aromatherapy ($n = 1$)
	Robot therapy ($n = 2$)
	Light therapy ($n = 1$)
	tDCS ($n = 1$)
Activity-orientated	Mindfulness training ($n = 1$)
	Exercise ($n = 1$)
Cognition-orientated	Staff education ($n = 1$)
	Story book ($n = 1$)
	Cognitive stimulation therapy ($n = 1$)
	Rehabilitation training ($n = 1$)
Multi-component orientated	Person-centred care ($n = 4$)
	Multi-disciplinary programme ($n = 1$)

4.2 | Transcranial Direct Current Stimulation (tDCS)

Elder et al. [44] found repeated consecutive sessions of tDCS on the parietal or occipital cortex did not improve visual hallucinations in 36 participants with Lewy body dementia, at day 5, 1-month or 3-month follow-ups. The control group received placebo tDCS. Impact on delusions were not reported.

4.3 | Aromatherapy

Lin et al. [43] involved 70 residents in 'care and attention homes' testing aromatherapy. Lavender or sunflower oil (control) was added to cotton in aroma diffusers by staff. Participants received two drops on each side of the pillow for at least 1 h nightly. No changes in delusion or hallucination scores from baseline to follow-up, measured using the Chinese version of the NPI, were reported.

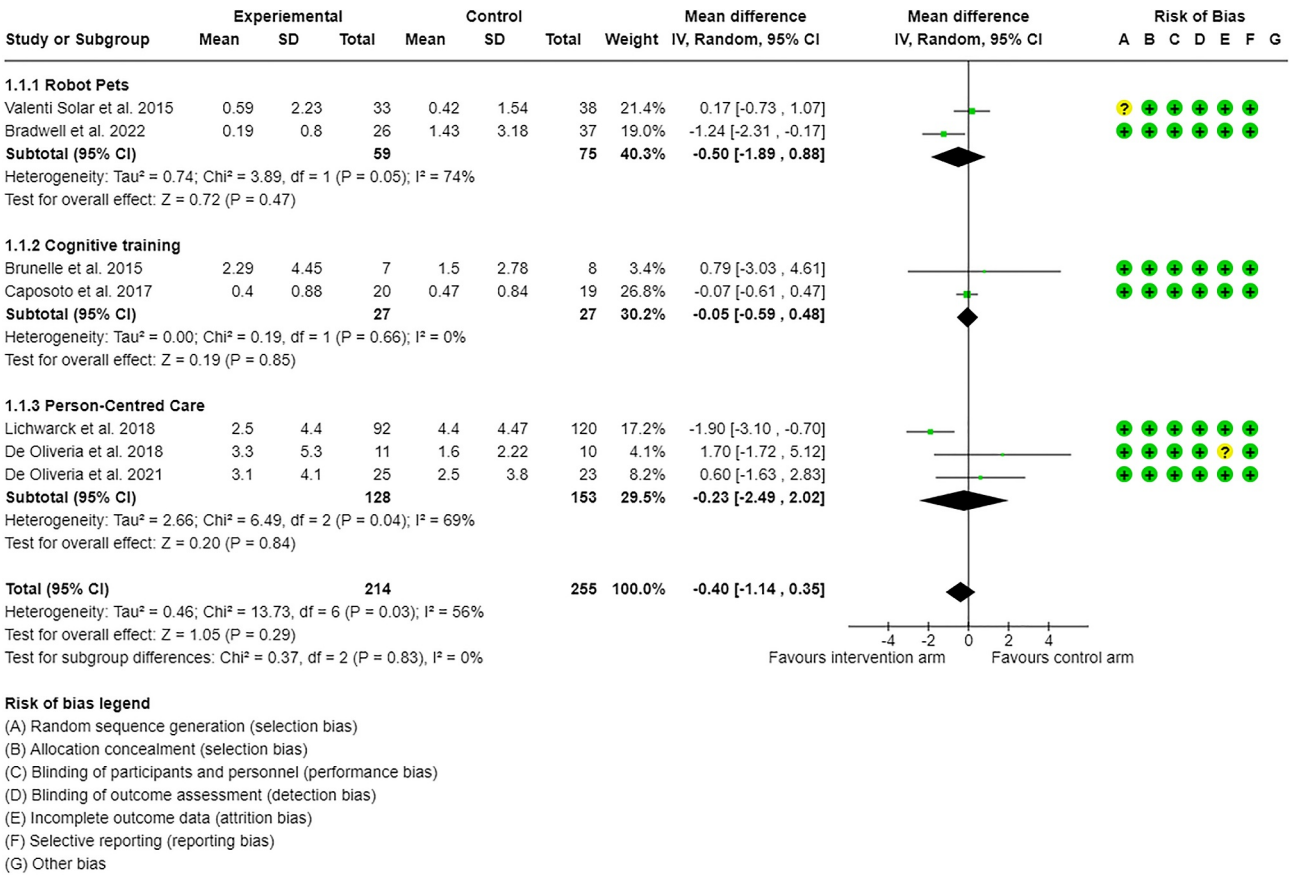

FIGURE 2 | Meta-analysis for delusions. Total = sample size.

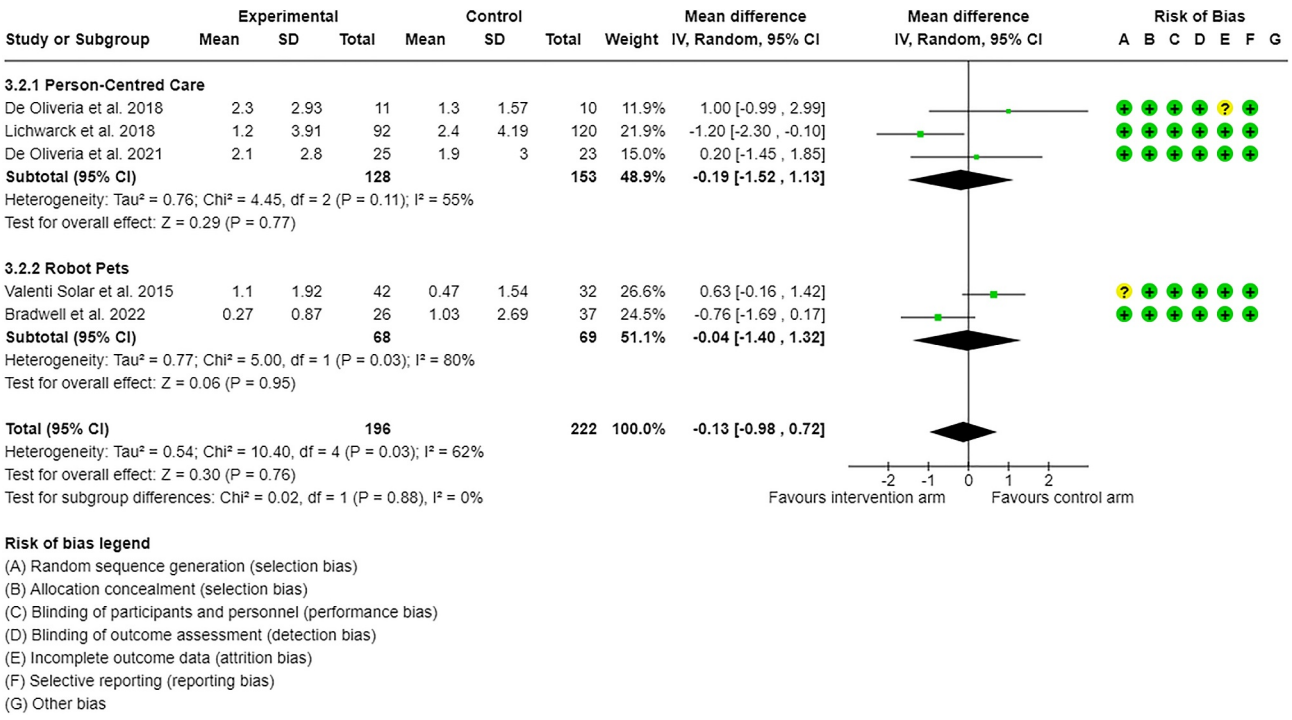

FIGURE 3 | Meta-analysis for hallucinations.

4.4 | Light Therapy

Dowling et al. [41] (n = 50) assessed light therapy in the morning (AM light) or in the evening (PM light) on delusions and found worsening of delusion symptoms post intervention for both intervention groups, against the control group who received indoor artificial light, for 1 h a day for 10 weeks. There were no significant changes in hallucinations.

4.5 | Music Therapy

Raglio et al. [38] assessed 60 nursing home residents. Both experimental and control groups received standard care, and the experimental group had three cycles of 12 music therapy sessions weekly. Delusions significantly improved from baseline to post-intervention (p = 0.002) in the music therapy group and were maintained at follow-up; delusions in the control group also improved, but not significantly. No significant within-group difference in hallucinations was observed. Comparisons between groups were not reported. Giovagnoli et al. [37] reported no improvements in delusions or hallucinations with active music therapy and 20 mg Memantine versus 20 mg Memantine alone (n = 55). Participants engaged in group musical instrument sessions for 40 min weekly over 24 weeks.

5 | Cognition-Orientated Interventions

5.1 | Cognitive Rehabilitation/Stimulation

Two studies [36, 42] examined cognitive training effects on delusions and were included in meta-analysis (Figure 2). Brunelle et al. [36] (n = 15) reported a significant reduction in delusion scores after 13 weeks of cognitive rehabilitation twice a week, re-learning tasks of the participant's choice for example using a remote control. Capotosto et al. [42] (n = 39) found no significant reduction in delusions with 7 weeks of group cognitive stimulation therapy twice a week (tasks tailored to participant's current ability). The meta-analysis indicated a nonsignificant overall effect on delusion reduction (MD = −0.05, 95% CI: −0.59 to 0.48, p = 0.85; Figure 3), with 0% I^2 statistic, suggesting no heterogeneity. Brunelle et al. [36] reported baseline hallucination scores as 0, and Capotosto et al. [42] report non-significant between group (p = 0.32) and within group (p = 0.97) analyses for hallucinations.

5.2 | Staff Education

Leone et al. [30] (n = 230) found psychosis scores significantly worse after nursing home staff education training compared to controls. Scores from baseline to week 4 increased in the intervention group ($p < 0.01$), but this difference did not remain significant at week 17.

6 | Life Story Book

Elfrink et al. [40] (n = 39) reported no significant effect on psychosis with an 'Online Life Story Book' for early-stage AD for up to 10 weeks but had a moderate effect size. Participants were based at home with the support of volunteers in creating their own story books compared to the control who received nothing. Comparisons between groups were not reported.

7 | Activity-Orientated Interventions

7.1 | Mindfulness Training

Giulietti, Spatuzzi, and Fabbietti [35] studied 44 patients at home with carer involvement. Participants underwent 6 months of structured training in mindfulness techniques, including stress management, compared to the control group who received nothing. No significant differences in delusions ($p = 0.226$) or hallucinations ($p = 0.185$) were reported from baseline to 6-month follow-up. Comparisons between groups were not reported.

7.2 | Exercise

Öhman et al. [39] compared exercise sessions (60 min twice a week for 12 months) to control in 59 participants in their homes or at day care centres. Sessions were individually tailored and included aerobic, strength, balance training, and dual tasking. No significant differences in delusions ($p = 0.31$) or hallucinations ($p = 0.97$) were reported from baseline to follow-up. Comparisons between groups were not reported.

8 | Multi-Component Orientated Interventions

8.1 | Person-Centred Care (PCC)

Four studies evaluated PCC interventions for delusions and hallucinations in dementia [34, 45–47] and three were included in the meta-analysis, in which all control groups received education only (Figures 2 and 3). Lichtwarck et al. [45] implemented an 8-week multi-component intervention for nursing home staff ($n = 17$ homes) based on education, cognitive behavioural therapy, and PCC, which resulted in a significant improvement in delusion scores for 229 residents who had dementia. De Oliveira et al. [46] found no significant effects from a tailored activity plan for people with dementia and their carers for 8 weekly sessions for 1 h, both in a pilot study ($n = 21$) and a larger study ($n = 54$) in 2021. The meta-analysis showed no significant effects on delusion reduction (MD = −0.23, 95% CI: −2.49 to 2.02, $p = 0.84$; Figure 2), with high heterogeneity ($I^2 = 69\%$).

All studies also explored impact on hallucinations (Figure 3), with the pooled overall effect showing no statistically significant improvement (MD = −0.19, 95% CI: −1.52 to 1.13, $p = 0.84$, $I^2 = 55\%$). Notably, Lichtwarck et al. [45] observed a statistically significant within group analysis in the intervention group for hallucinations within the initial 9 weeks ($p = 0.023$) but was not sustained from week 0 to week 12 ($p = 0.079$). In contrast, the remaining two studies, conducted by de Oliveira et al. reported no significant changes in hallucination levels post-intervention between groups.

Rokstad et al. [34] ($n = 426$) reported a combined score of psychosis and so was not included in the meta-analysis. This paper found significant reductions in psychosis scores for participants ($n = 624$) in both intervention groups compared to the control, for Dementia Care Mapping (−0.9; CI [−1.4; −0.3] $p < 0.01$) and 'VIPS' practice Model (VPM) (−0.6; CI [−1.1; −0.04] $p < 0.04$), which involved weekly lectures and meetings for nursing home staff ($n = 14$ care homes). DCM was used as a process to develop the staff's skills in delivering PCC and VPM used a framework centralised around PCC. DCM used observations of care and feedback from external experts, whereas VPM gave staff central roles in decision-making with no external experts involved.

8.2 | Multi-Disciplinary Programme

Bakker et al. [31] also reported combined scores of psychosis. The 15-week admission to a specialised psychiatric-skilled nursing home, with personalised interventions for emotions, personality, life events, social functioning, cognitive functioning, and somatic functional disorders had no significant impact on scores of psychosis compared to usual care group (MD = −1.21 (6.79) $p = 0.38$).

8.3 | Meta-Analysis Pooled Effect

Pooled effects of the interventions were non-significant for delusions (MD = −0.40, 95% CI: −1.52, 1.13, $p = 0.83$, $I^2 = 69\%$) and hallucinations (MD = −0.13, 95% CI: −0.98, 0.72, $p = 0.88$, $I^2 = 62\%$) and both had high levels of heterogeneity.

9 | Quality of Life (QoL)

Five papers report on changes in QoL in people with dementia. Three out of the five papers utilised QUALID [33, 34, 45] whereas two reported on health-related quality of life with the use of SF-20 and EQ5D [31] and SF-36 [35].

9.1 | Mindfulness Training

Giulietti, Spatuzzi, and Fabbietti [35] demonstrated that the QoL improved in patients after 6 months of MBI training ($p < 0.001$), who also showed an increase in cognition and spiritual well-being.

9.2 | Person-Centred Care

Rokstad et al. [34] reported a significant difference in the QUALID scores between the DCM group and the control group, indicating a positive effect of the DCM intervention on the patients' QoL. There was no change in the VIPS group for QoL. The between-group differences in change at 12 weeks was 1.6 (95% CI: 0.04–3.5; $p = 0.01$). There was no within group analysis.

Lichtwartz et al. [45] found QoL was improved significantly at week 12 for the TIME intervention compared to control. The

between-group differences in this change at 12 weeks was 1.6 (95% CI: 0.04–3.5; $p = 0.01$) and report no within-group analysis.

Bakker et al. [31] reported no significant difference in QoL between control group and intervention group for the multidisciplinary programme.

9.3 | Robot Pets

Soler et al. [33] reported improvements for the control group in the QUALID scale. However, those who interacted with the animal robots showed slightly worsening in QoL. There were no between or within group analyses reported.

9.4 | Safety Assessment and Cost Effectiveness

Two out of the 18 papers reported cost and 3/18 reported safety analysis. Mindfulness [35] and online life story book [40] were reported as 'low-cost', in which Elfrink describe the use of volunteers as a key factor in its cost-effectiveness. No adverse events were reported to be related to aromatherapy [43] and tDCS [44]. One paper that reported the most adverse events involved memantine and active music therapy [37] which included insomnia, somnolence, and depression.

10 | Discussion

10.1 | Summary

This systematic review identified 18 RCTs assessing the impact of non-pharmacological interventions on dementia-related psychosis in people with dementia living in the community. The overall quality of these studies was reasonable (13/18 at low risk of bias). The results of the meta-analysis show that at present there is no evidence that non-pharmacological interventions are effective at reducing symptoms of psychosis. This may be partly due to the low number of studies that have been conducted and the heterogeneity of interventions tested. Interventions which reported significant reductions in symptoms of psychosis in individual studies included person-centred care, robot pets, music therapy, and cognitive rehabilitation. Mindfulness training and dementia care mapping also showed some evidence in improving quality of life in people with dementia. These are areas for further research.

10.2 | Relationship to Previous Literature

Due to the substantial risks associated with pharmacological treatments in people with dementia, non-pharmacological interventions have gained prominence. Numerous studies have examined interventions for various dementia symptoms, including BPSD, anxiety, apathy, agitation, and pain, demonstrating varied outcomes with notable improvements [22, 25, 48–50]. The results from this review indicated some marginal improvements in delusions with music therapy, and this intervention has previously demonstrated improvements for agitation [22], BPSD [48] and anxiety [49]. Person-centred care which also showed some improvements in delusions and psychosis, has been evidenced to improve agitation [48], depression and neuropsychiatric symptoms [51]. Moreover, robot pets have been showed to be effective for agitation, depression, and quality of life [52]. While these interventions have efficacy for addressing other dementia symptoms, their potential in managing psychosis warrants further exploration.

10.3 | Strength and Limitations

This review, the first in its field, was methodologically robust with benefits of dual-screening, dual data extraction, and thorough searching across a wide variety of databases. The review also has some limitations, including unresponsive authors leading to the exclusion of relevant papers from the meta-analysis. The meta-analyses also had high heterogeneity, due to the diversity of the interventions and participants.

10.4 | Implications for Research

At present, in terms of efficacy of reducing D-RP symptoms alone, non-pharmacological interventions cannot currently be recommended. However, there is preliminary evidence of four intervention types which may be promising for D-RP and warrant further RCTs to fully evaluate their efficacy. The aims of 17 out of 18 of the included studies were developed to address wider BPSD, not specifically hallucinations or delusions, which may explain the non-efficacious results. Thus, developing interventions that specifically target D-RP is important. Moreover, there was limited understanding on safety and cost-effectiveness due to a lack of available evidence and exploration, emphasising the need to include these outcomes in future research. Although non-pharmacological interventions are likely to produce fewer side-effects than antipsychotics, further analysis of their safety is recommended in future clinical trials to evidence this.

10.5 | Conclusions

Evidence to support the use of non-pharmacological interventions for symptoms of psychosis in dementia is limited at present. Future research needs to focus on developing non-pharmacological interventions specifically targeted at psychosis symptoms.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.