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Non-pharmacological interventions to reduce neuropsychiatric symptoms in hospitalised patients for behavioural crises with cognitive impairment: A systematic review

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ABSTRACT

Non-pharmacological interventions are pivotal to reducing neuropsychiatric symptoms (NPS) in patients with cognitive impairment. This systematic review assessed the effectiveness of non-pharmacological interventions applicable by nursing staff to reduce NPS in older patients with cognitive impairment hospitalised for behavioural crises. Six databases were searched for randomised or non-randomised controlled trials. Two authors screened full-texts and assessed the quality of the studies using the Modified Downs and Black Checklist. Results were presented narratively using the PRISMA guideline. Only five studies could be included, all were conducted in geriatric psychiatry. Three studies showed significant effects on NPS. They tested physical exercise, behavioural activation for meaningful activity and listening to individualised music and were of good, moderate and low quality, respectively. The best evidence was found for physical exercise. Due to the small number of studies with heterogeneous quality, the results must be interpreted with caution, limiting the scope of conclusions. While more research is needed, we recommend that non-pharmacological interventions in clinical practice be adjusted to patient characteristics, contextual factors and existing care practices.

Introduction

Neuropsychiatric symptoms (NPS) are common in older people with cognitive impairment,[1] with an increased prevalence in those with more severe cognitive impairment, including dementia.[2] NPS include heterogeneous symptoms like 'agitation, depression, apathy, repetitive questioning, psychosis, aggression, sleep problems, wandering and a variety of inappropriate behaviours'.[3] These symptoms are also common in people with mental illness.[4,5] Mental illness, in turn, is associated with faster cognitive decline.[6,7] Therefore, almost all older patients with cognitive impairment hospitalised for behavioural crises (e.g. in geriatric psychiatry) experience some NPS. These symptoms often cause a downward trajectory, of cognitive decline,[1] a reduced quality of life, and poor patient outcomes, such as increased mortality and an increased risk of institutionalisation and hospitalisation.[3,8,9] NPS is one of the most burdensome aspects of caring for people with dementia and can negatively affect health professionals' and informal caregivers' well-being, which in turn can have a negative effect on people in need of care.[10,11] NPS can be seen as reactive or need-driven behaviours or responses to stressful stimuli or unmet needs, such as thirst, boredom or sensory overload in a person with cognitive impairment.[3] When a situation becomes too distressing and burdening for the person with cognitive impairment and NPS, it can even lead to a so-called 'behavioural crisis' and subsequent hospitalisation.[12,13] Behavioural crises in dementia are defined

Abbreviations: NPS, neuropsychiatric symptoms; NPI, neuropsychiatric Inventory; CMAI, Cohen–Mansfield agitation; ADCS-CGIC, Alzheimer's disease cooperative study–clinical global impression of change; NRS-R, neurobehavioral rating scale–revised; GDS-S, geriatric depression scale–short form

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[1] https://www.upd.ch/de/
[2] https://www.bfh.ch/health-professions/en/
[3] https://www.pzmag.ch
[4] https://www.maastrichtuniversity.nl/about-um/faculties/faculty-health-medicine-and-life-sciences-0

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by Vroomen as 'a process where a stressor causes an imbalance requiring an immediate decision to be made which leads to a desired outcome and therefore a resolution of the crisis'.[14(p.1)] We also consider this definition appropriate for people with cognitive impairment and perhaps more predominant mental illnesses. Factors associated with causing behavioural crises and following hospitalisation include agitation and aggression, delusions, wandering and underlying somatic conditions, such as infection.[12,13] In addition, caregiver-related factors may also influence behavioural crises,[12] including how they experience and deal with NPS and stressful and emotional situations. Understanding how NPS, somatic conditions, and caregiver-related factors contribute to behavioural crises requires recognizing their interrelationships. For example, agitation in a person with cognitive impairment can make it difficult for caregivers to support adequate fluid intake, while dehydration itself is a risk factor for NPS and delirium.

Once a patient is admitted to hospital, they may be further challenged by the unfamiliar hospital environment and the disruption of routine.[15,16] The goal of hospitalising older patients admitted for behavioural crises typically involves stabilising them by reducing their NPS.[13,17] This usually involves somatic, pharmacological and psychosocial interventions. These interventions include, for example, interprofessional care planning, treatment of infections, rehydration, behaviour management strategies and various therapies, such as occupational therapy and physiotherapy.[13,18] In general, non-pharmacological interventions are recommended to reduce NPS as a first-line treatment or if pharmacological interventions have failed to reduce symptoms.[19,20] This is because pharmacological interventions, such as antipsychotic drugs, have modest efficacy but can also have serious side effects.[21,22] To the best of our knowledge, it is not yet known whether non-pharmacological interventions provided by nursing staff in daily practice to reduce NPS are a helpful contribution to the existing treatment practices during hospitalisation for behavioural crises described as above. We use the term *non-pharmacological interventions* to refer to interventions that are provided explicitly to reduce NPS in the daily care of patients. This could be massage, music, reminiscence therapy or behavioural-management techniques. To use non-pharmacological interventions effectively in clinical practice as a first-line treatment to reduce NPS in hospitalised older patients with cognitive impairment in behavioural crisis, knowledge about evidence-based interventions is needed. Based on two umbrella reviews not limited to a specific setting, there is good evidence for reducing NPS with music interventions and behaviour-management techniques.[23,24] In addition, one umbrella review also found evidence for caregiver-based and organisational interventions, including staff training, person-centred care and dementia care mapping.[23] Detailed recommendations for specific interventions for specific NPS can also be found in the NICE guideline from the National Institute for Health and Care Excellence and the German 'S3-Leitline'.[19,20] Most of the included studies in the umbrella reviews and guidelines were conducted in residential aged care or community settings.[19,20,23,24] Settings where patients are hospitalised for behavioural crises, such as a geriatric psychiatric setting, were seldom the site of these studies. As far as we know, there is a research gap on this topic in this specific population and setting, as we could not find a review.

The transfer of the existing evidence of non-pharmacological interventions appears difficult due factors related to behavioural crises and factors specific for the geriatric psychiatric setting. For example, the hospitalisation for behavioural crisis in an unfamiliar environment and the frequent NPS in this specific setting such as aggression, agitation and wandering may influence which non-pharmacological interventions are most effective in reducing NPS. In addition, the feasibility of certain non-pharmacological interventions may be limited by the high workload of nursing staff, prioritisation of medical procedures and care routines, which can be challenged by the presence of NPS. Therefore, this systematic review aims to summarise the current effectiveness of non-pharmacological interventions to reduce overall NPS or specific NPS in older patients with cognitive impairment hospitalised for behavioural crises. Our secondary aim is to report on adverse events, as well as on the facilitators of and barriers to the provision and participation of non-pharmacological interventions in the included studies. This will provide insight into what is important when implementing these interventions in clinical practice.

Material and methods

Design

To summarise the current evidence on non-pharmacological interventions to reduce NPS in older patients with cognitive impairment hospitalised for behavioural crises, a systematic review with narrative synthesis was chosen.[25] The PRISMA guideline was used for reporting,[26] and the protocol was registered in the PROSPERO database (CRD42023433680).

Eligibility criteria

We included randomised controlled trials (RCTs) and non-randomised controlled trials (N-RCTs) testing non-pharmacological interventions to reduce any NPS in older patients (age $\geq$ 65 years) with cognitive impairment hospitalised for a behavioural crisis. We included studies with participants with Alzheimer's disease or Lewy body or vascular dementia but excluded studies involving any other specific type of dementia. This was done because of the different symptomologies and needs of affected people with other types of dementia. Table 1 shows the detailed inclusion and exclusion criteria according to the PICO scheme (patient, intervention, control group, outcome), setting, study design and publication type.[27] The inclusion criteria were publications in English or German and published after 2008. This 15-year limit was set to include only contemporary publications, as practices change over time.

Search strategy

On 17 and 18 June 2023, EB performed a search in the electronic databases PubMed, CINAHL ultimate (EBSCO), APA PsycINFO (Ovid), Web of Science (WoS), Cochrane Library and Embase.

The search query consisted of combined blocks of keywords and/or MesH terms or subject headings relating to cognitive impairment, NPS, non-pharmacological interventions and 'behavioural crisis or the geriatric psychiatric setting'. Terms related to the 'geriatric psychiatric setting' were used in addition to 'behavioural crisis; this was necessary because the term 'behavioural crisis' is not commonly used, and when people with cognitive impairment are admitted to a geriatric psychiatric setting, they are likely to be admitted for behavioural crises. A librarian not otherwise involved in the review checked the query for PubMed. This PubMed query was then adapted for the other databases. Since a primary search in all databases yielded 22,455 results, we refined the query by removing the MesH or subject headings for NPS and some keywords that are often used in neuroscientific studies but are too vague for this review (e.g., anxiety, sleep disorder, hallucination, hospital, clinic and, in PsycInfo and Embase, cognitive training and behavioural therapy). When we tested the new search string, all five predefined reference studies were included in the search results. The search was updated in all databases on 30 October 2023, but no new suitable references were found. (The search strategy for PubMed is attached in the

Table 1
Inclusion and exclusion criteria.

	Inclusion criteria	Exclusion criteria
Patient	- Age ≥ 65 years - Cognitive impairment (dementia) - Any NPS (including specific symptoms such as depressive symptoms or overall NPS as complex) - Hospitalised for behavioural crisis	- Early-onset dementia - Any specific dementia other than Alzheimer's disease or Lewy body or vascular dementia: e.g. Parkinson's disease or frontotemporal dementia - Hospitalised due to medical problems
Intervention	- Non-pharmacological interventions directly delivered to patients - Interventions appear to be relevant to the reduction of NPS, feasible for nurses to deliver and integrable into acute care settings.	- Educational or organisational interventions, such as training programmes, person-centred care or dementia care mapping
Control	- Treatment as usual or comparative control conditions - Pharmacological intervention	
Outcome	- Overall NPS as a complex - Any specific NPS, such as agitation, depression, apathy, repetitive questioning, psychosis, aggression or wandering	
Setting	- Any setting where patients are acutely hospitalised for a behavioural crisis, such as geriatric psychiatry or geriatric psychiatric units	
Study design	- Randomised and non-randomised trials	
Publication type	- Published peer-reviewed articles	- Books - Grey literature - Conference abstracts

Note. NPS: neuropsychiatric symptoms.

supplementary material, Document A.) In addition, the cited references of the included study reports were examined.

Study selection method and data extraction

The results of the search were imported into Endnote X9.3.3. Duplicates identified by Endnote were visually checked and removed. One author (EB) screened the titles for potential eligibility. The remaining studies were imported into Covidence systematic review software (2023). EB and SB independently screened the abstracts in a first step and the full text in a second step to determine final eligibility. Disagreements were resolved by discussion, and a third researcher (SH or SZ) was asked to support the decision. EB extracted the data according to the protocol registered on the PROSPERO database using the Covidence systematic review software (2023). The following data were extracted: references, study design, setting, participants (sample size, mean age (SD), cognitive impairment (SD), psychiatric diagnosis other than dementia), intervention (individual or group intervention, description of the intervention, period, frequency and duration of the intervention, actually delivered interventions, provider, personally tailored aspects, compliance with the intervention, acceptability by the provider and participants), control condition and outcomes (outcome measures for overall NPS or any specific NPS). In addition, for the secondary aim of the review, adverse effects and facilitators of and barriers to the provision and participation of the interventions were extracted. If possible, outcomes on pre- and post-measurement were used.

Quality appraisal

The study quality was assessed by two authors independently (EB and SB) using the Modified Downs and Black Checklist,[28] and conflicts were discussed with a third person (SH or SZ). This often used and well accepted checklist of 27 items is designed to assess the methodological quality and bias of randomised and non-randomised controlled trials.[29] The checklist is reported to be reliable, as indicated by a Kuder-Richardson 20 value of .89, demonstrating good internal consistency.[30] It's subdomains of reporting 'external validity', 'internal validity – bias', 'internal validity – confounding (selection bias)' and power allow for comprehensive assessment.[28] This is particularly important for non-randomised studies.[29] The Modified Downs and Black Checklist uses total scores to rate the quality of the studies.[29] After assessing the quality of each study, we compared the overall scores of the studies and rated their overall quality based on the results of the subdomains without using total scores.[31] We did not use the quality assessment as an exclusion criterion for the quality of a study.

Results

The systematic search in the databases retrieved 1,872 results, of which 161 duplicates were removed and 221 abstracts were screened by two authors; of these, 44 full texts were screened by two authors. In addition, two references were found by citation searching (not included in the PRISMA diagram) but excluded after full-text screening by two authors. In total, five full-text articles were eligible for inclusion. The main reason for exclusion during full-text screening was that patients were not hospitalised for a behavioural crisis. If the hospitalisation was in a general hospital and the reason for hospitalisation was not explicitly related to a behavioural crisis or NPS, the study was excluded. As shown in the PRISMA diagram in Fig. 1, in the end, five studies were included.

Study characteristics

Three randomised controlled trials,[32–34] one non-randomised controlled trial[35] and one non-randomised bench-mark controlled trial[36] comprising in total 403 participants were included. Three studies were conducted in the United States,[32,33,35] one in Finland[36] and one in Germany.[34] All studies were conducted in a geriatric psychiatric institution, and two studies were conducted in the same institution but used different interventions and outcome measures.[32,33] Participants mean age ranged from 70.6 (± 5.6)[33] to 80 (±7).[34] Depending on the study, the participants had either mild cognitive impairment with frequent psychiatric comorbidities[32,33] or moderate cognitive impairment[32,33] or dementia.[35] Studies assessed overall NPS,[34,36] depressive symptoms,[32,35] or/and agitation[34,35] by participant-based[32,33] or proxy-based information.[34–36] The studies used pre- and post-outcome measures, with the exception of one study.[35] An overview of the included studies is shown in Table 2.

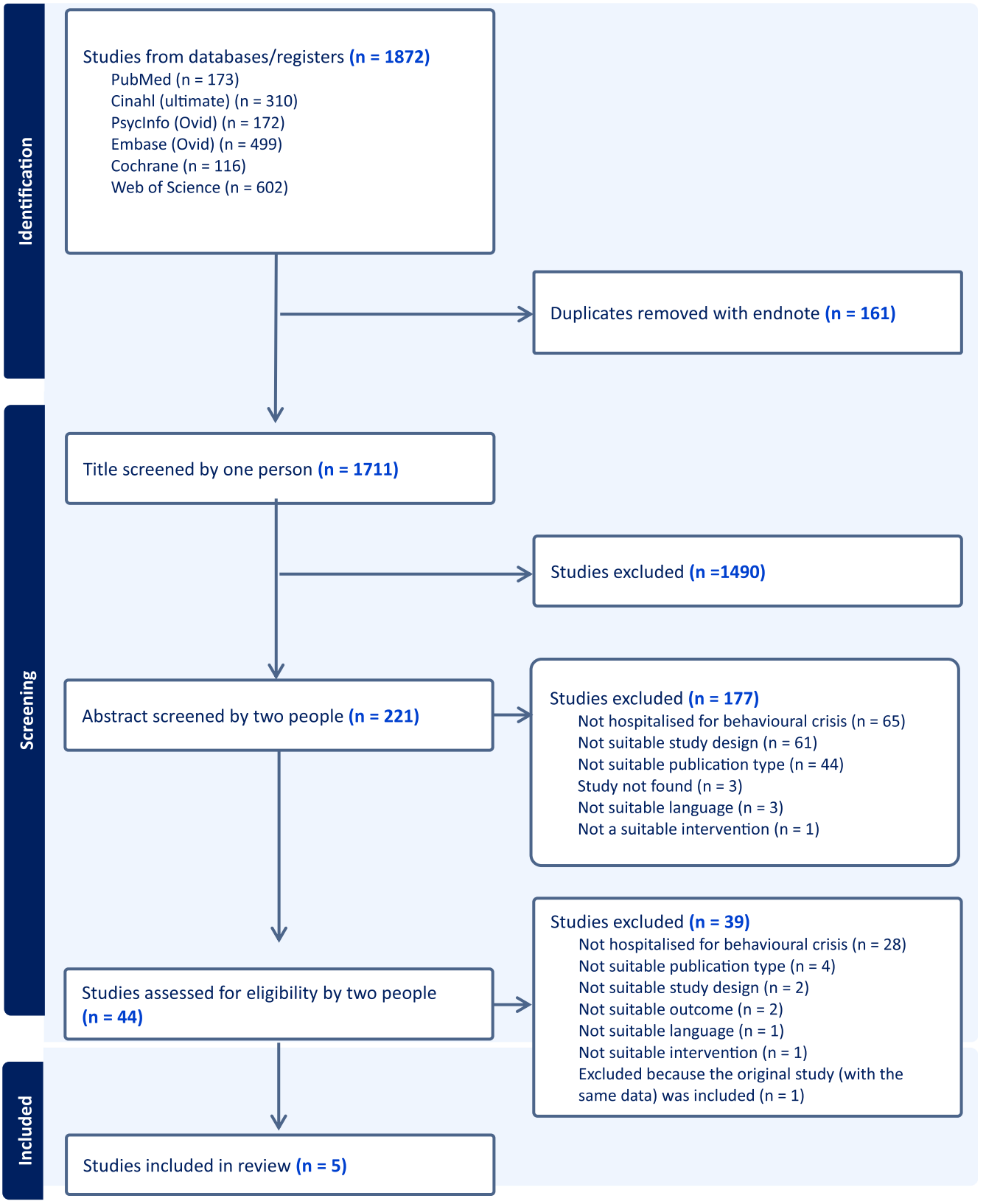

Fig. 1. PRISMA flow chart; adapted from Covidence systematic review software (2023).

Table 2
Overview of the included studies.

Reference / year / country	Study design	Sample size	Mean age (SD)	Cognitive impairment (SD)	Psychiatric diagnosis*	Intervention	Control condition	Assessed symptoms/	Outcome measures
Fleiner et al. (2017) Germany	RCT	85	80 (±7)	MMSE: 18.4 (±4.8)	-	Physical exercise	Social stimulation program	- Overall NPS - Agitation - Clinician's perception of change	- NPI - CMAI - ADCS-CGIC
Pitkänen et al. (2019) Finland	Non-randomised BCT	175	77.9 (±8.4)	MMSE: 13.3 (±7.4)	-	Implementation of physical exercise and music sessions into the treatment process at ward level	TAU	- Overall NPS	- NPI
Schroeder et al. (2018) USA	N-RCT	41	74.1 (-)	SLUMS: 11.4 (±8.9)	-	Listening to individualised music	TAU	- Agitation - Negative emotions	- Self-made tools
DiNapoli et al. (2016) USA	RCT	52	70.6 (± 5.6)	SLUMS: 21.4 (± 3.7)	80%	Individualised social activities	TAU	- Overall NPS	- NRS-R
Snarski et al. (2011) USA	RCT	50	71.7 (±5.9)	MMS: 24.8 (± 2.9)	82%	Behavioural activation	TAU	- Affective symptoms	- GDS-S

Note. - : no information available; RCT: randomised controlled trail; BCT: benchmark controlled trail; N-RCT: non-randomised controlled trail; NPS: neuropsychiatric symptoms; TAU: treatment as usual; MMSE: Mini Mental Status Examination (total score 30. ≤ 9 indicates severe, 10−20 moderate, 21−24 mild cognitive impairment. ≥ 25 is normal,[37,38]); SLUMS: Saint Louis University Mental Status (total score 30. For people without a high school level of education: 23.5 cut-off score mild for cognitive impairment and 19.5 for dementia. For people with a high school level of education: 25.5 cut-off score mild for cognitive impairment and 21.5 for dementia,[39]); NPI: Neuropsychiatric Inventory[40]; CMAI: Cohen-Mansfield Agitation Inventory[41]; ADCS-CGIC: Alzheimer's Disease Cooperative Study—Clinical Global Impression of Change[42]; NRS-R: Neurobehavioral Rating Scale-Revised[43]; GDS-S: Geriatric Depression Scale—Short Form[44]; * Psychiatric diagnosis other than dementia.

Quality appraisal

Table 3 presents the quality appraisal of the 27 items based on the questions of the appraisal tool. (The detailed quality appraisal is attached in the supplementary material, Document B.) The overall quality of the reported studies varied from poor[35] to moderate[32,33,36] to good.[34] The main weaknesses in all studies were related to rather small sample sizes with high attrition rates and the risk of bias due to less-controlled conditions, such as the lack of blinding of participants and/or assessors and in two studies additionally to non-randomisation.[35,36] While the study, rated as having 'good' quality,[34] exhibited some potential for confounding bias related to not achieving its target sample size and not including losses in the analysis, this risk was judged not to substantially lower the study's overall quality. Studies rated as having only 'moderate' or 'low' quality were primarily downgraded due to the use of convenience samples including referrals,[32,33] less controlled conditions[35,36] (in one case because of the benchmark controlled design[36]), an outcome measure deemed insufficient to capture changes in NPS,[33] and deficiencies in reporting.[35] Furthermore, except the study used an outcome measure deemed insufficient to capture changes in NPS,[33] three studies[32,34,36] used reliable and widely used outcome measures to assess NPS,[44−46] and one study used self-made tools that were not psychometrically tested.[35] Whether the interventions were delivered as planned was unclear in two studies because it was not reported how many of the planned interventions were delivered[35] or because of the potential incomplete implementation of the intervention.[36]

Characteristics of the interventions

The studies examined the effectiveness of physical exercise (at a rather high level of intensity and frequency),[34] the implementation of physical exercises and music sessions at the ward level,[36] listening to individualised music[35] and meaningful activities.[32,33] *Meaningful activities* included behavioural activation in face-to-face treatment sessions to activate participants' engagement with activities themselves[32] and engaging with participants in individualised social activities.[33] Interventions were delivered on an individual basis[32,33,35,36] and/or group basis.[34,36] In addition, all interventions had some personally tailored aspects, and the period in which the interventions were delivered ranged from two weeks[34] to the entire hospital stay.[36] Overall the interventions were quite heterogeneous. Table 4 details the interventions, including their description, the period during which the intervention was delivered, the frequency and duration of the intervention, the interventions ultimately delivered, compliance with the intervention and its acceptability.

Effectiveness in reducing neuropsychiatric symptoms

Three of the five studies showed a significant result in that the non-pharmacological intervention contributed to a reduction in NPS.[32,34,35] These studies tested physical exercise,[34] meaningful activities (specifically behavioural activation[32]) and listening to individualised music.[35] These studies were of good,[34] moderate[32] and low quality,[35] respectively. The study tested physical exercise found significant results on overall NPS based on the NPI.[34] There were also significant results based on the ADCS-CGIC, which considers the impression of change by clinicians on agitation, aggression and lability, but no significant results were found for agitation based on the CMAI.[34] However, as this study was the only one of good quality, we consider physical exercise to be the intervention with the best evidence we have found to reduce NPS. Two studies of moderate quality that provided meaningful activities (individualised social activities[33]) or implemented physical exercise and music sessions at the ward level[36] found no significant reduction in NPS. Furthermore, in all

Table 3
Quality appraisal of the included studies.

	Item	Fleiner et al., 2017	Pitkänen et al., 2019	DiNapoli et al., 2016	Snarski et al., 2011	Schroeder et al., 2018
Reporting	1.	✓	✓	✓	✓	✓
	2.	✓	✓	✓	✓	✓
	3.	✓	✓	✓	✓	-
	4.	✓	✓	✓	✓	-
	5.	±	✓	✓	±	±
	6.	✓	✓	-	✓	✓
	7.	✓	✓	✓	✓	-
	8.	✓	✓	-	-	✓
	9.	✓	✓	✓	✓	-
	10.	✓	✓	✓	✓	-
External validity	11.	?	?	-	-	?
	12.	?	?	-	-	?
	13.	✓	✓	✓	✓	✓
Internal validity - bias	14.	-	?	-	?	?
	15.	✓	-	✓	✓	?
	16.	-	-	?	-	✓
	17.	✓	✓	✓	✓	?
	18.	✓	✓	✓	✓	✓
	19.	✓	-	✓	?	?
	20.	✓	✓	-	✓	✓
Internal validity confounding – (selection bias)	21.	✓	✓	✓	✓	✓
	22.	✓	-	✓	✓	-
	23.	✓	-	✓	✓	-
	24.	✓	-	✓	-	-
	25.	-	-	✓	✓	?
	26.	-	-	✓	✓	?
Power	27.	-	-	✓	✓	-

Note. ✓: item achieved; -: item not achieved, ±: item partially achieved (only possible for items 1 to 10); ?: no information available.

studies with a pre-and post-treatment assessment, NPS decreased in both the intervention and control groups.[32–34,36] Table 4 details the results of the studies.

Secondary aim

Adverse effects

Only one study reported possible adverse effects from non-pharmacological interventions.[36] They found a correlation between the dosages of antipsychotics and anxiolytics and music interventions in an exploratory analysis. The authors hypothesised that some interactive music interventions, such as singing or playing rhythm instruments, may have caused overstimulation in some patients. The study tested physical exercise at quite a high intensity and frequency and found an associated increased use of anxiolytics, which the authors consider not clinically relevant, as it only affected a few participants.[34]

Facilitators of and barriers to the provision of and participation in the interventions

The need for few staff resources for listening to individualised music[35] was discussed as a facilitator in providing non-pharmacological interventions and clinical expertise or training in how to engage with people with cognitive impairment even as a requirement.[32] Conversely, the pressures of routine work and the complexity of implementing the new treatment procedures[36] were discussed as barriers to the implementation of physical exercises and music sessions at the ward level. Concerning participation in the intervention, the possibility of flexible participation several times per day[34] was discussed as a facilitator of the participation in the intervention. Also mentioned as challenges to participation were difficulties concentrating due to the acute illness[36] and limited time in the hospital, as well as subsequent difficulties in completing the whole treatment protocol.[32]

Discussion

To the best of our knowledge, this is the first systematic review of the effectiveness of non-pharmacological intervention to reduce NPS in older patients with cognitive impairment hospitalised for behavioural crises. The studies reviewed the effectiveness of physical exercise, music and meaningful activities and were all conducted in geriatric psychiatric settings. We found heterogeneous results from a small number of included studies with mostly rather small sample sizes, high attrition rates, and limited quality related to their relatively less-controlled conditions. Therefore, our results should be interpreted cautiously. Even then, the most promising intervention with the strongest evidence we found was physical exercise, tested by the highest (good) quality study.[34] An overall very well-designed exercise programme, with several short rather high-intensive sessions per day, delivered by an exercise instructor reduced overall NPS on the NPI, significantly. The high frequency (and intensity) is probably a reason for its promising results. A recent systematic review on the reduction of NPS (not limited to a specific setting) confirms that physical exercise reduces NPS in people with cognitive impairment.[48] Therefore, a certain frequency seemed to be required, e.g. 20–30 min of walking most days a week.[48]

In contrast, a moderate quality-study included in our systematic review that implemented physical exercise (and music sessions) at the ward level failed to demonstrate a significant reduction in overall NPS using the NPI.[36] This outcome may be attributed to the low frequency of physical exercise, as participants averaged only one session per week. The authors reported challenges in implementing the intervention, which was mostly delivered by nursing staff within existing care routines, also due to the pressures of routine work. Notably, using exploratory analysis, the authors could also show an association between fewer exercise sessions and increased NPS severity. While it seems feasible that nursing staff incorporate some physical exercise into their daily nursing practice, replicating the high intensity and frequency used by the high-quality study[34] to

Table 4
Characteristics and effectiveness of the interventions.

Reference	Intervention (individual or group intervention): Description	Period during which the intervention was delivered Frequency and duration of the intervention Interventions ultimately delivered	Provider	Compliance with the intervention	Acceptability to the provider / participants	Study quality	Significant results: Yes / No Results
Fleiner et al. (2017)	Structured physical exercise (group intervention): Opportunity to participate in several short exercises a day, including strengthening and endurance exercises, in groups of three patients. Overall rather high intensity.	Over 2 weeks 3 days a week, four 20-minute sessions per day On average, participation was 128 min/week.	Exercise instructor[47]	A flexible approach should facilitate participation.	- / -	Good	NPI: Yes IG: 22.5 (±12.3) to 10.3 (±7.3) CG: 22.5 (±13.9) to 16.2 (±9.9) ($F(1, 68) = 4.4$, $p = .04$, $d = 0.51$) CMAI: No IG: 51.4 (±12.5) to 41.7 (±10.2) CG: 51.3 (±12.4) to 45.5 (±10.7) ($F(1, 68) = 2.6$, $p = .11$, $d = 0.40$) ADCS-CGIC: Yes ADCS-CGIC decreased significantly more in the intervention group than in the control group in 4 out of 5 subdomains.
Pitkänen et al. (2019)	Implementation of physical exercises and music sessions at the ward level (individual and group intervention): This included balance, flexibility and strength training (either sitting or standing), walking, relaxation exercises, singing or listening to familiar songs, playing percussion instruments, dancing and discussing feelings and memories.	Over the entire hospital stay Frequency was individually planned On average, participants participated in 7 exercise and nine music sessions during an average stay of 47 days.	Physiotherapist, physical education instructor, registered nurses, practical mental-health nurse	The delivery of the interventions may have been affected by high work pressure and incomplete implementation.	- / -	Moderate	NPI*: No IG: 33.2 (±20.2) to 16.9 (±14.4) CG: 34.6 (±25.4) to 19.5 (±19.7) Difference in changes (*t*-test): $p = .73$ Based on an explanatory analysis (LLM), fewer exercise sessions were associated with higher NPI scores ($p = .030$).
Schroeder et al. (2018)	Listening to individualised music with iPods (individual intervention): Participants were given an iPod (with headphones). 31 music playlists were created beforehand, grouping songs by decade, genre or individual artist, from which the participants or a representative family member could choose a playlist.	Period during which the intervention was delivered remains unclear. It was recommended that participants listen to music for at least 30 min each day in the morning. iPods could also be used as a PRN iPod. It remains unclear how many interventions were actually delivered.	Recreational therapist, nursing staff	-	The intervention would not have been burdensome for staff. / Participants seemed to enjoy it.	Poor	Self-made tool for agitation: Yes IG: 1.81 vs. CG: 4.08, $p \leq .01$ (Mean scores over hospital stay) Self-made tool for negative emotions: Yes IG: 4.51 vs. CG: 6.84, $p \leq .01$ (Mean scores over hospital stay)
DiNapoli et al. (2016)	Individualised social activities (individual intervention): Based on participants' interests and functional status, a list of potential activities was created, and activities were provided. Frequently provided activities were reminiscence, life review, casual conversation, puzzles, cards, board games, listening to music and doing art.	Up to 15 consecutive days Interventions were 30–60 min. On average, participants attended 13 sessions.	Trained research assistant, therapists	Most sessions were delivered appropriately (93%) by the therapists, and participants were actively engaged during the sessions.	- / Participants found the intervention very to extremely helpful (82.6%) and very well suited for them (91.3%).	Moderate	NRS-R: No IG: 12.65 (±8.53) to 7.19 (±5.58) CG: 13.75 (±7.27) to 10.4 (±6.97) $F(1, 48) = .67$, $p = .42$
Snarski et al. (2011)	Behavioural activation (individual intervention): Face-to-face treatment sessions aimed to increase participants' engagement in activities related to their life goals. Participants also received homework (e.g., participating in recreational therapy or doing exercises).	Over four weeks Eight 30-minute sessions It remains unclear how many interventions were actually delivered.	Lead author, a clinical psychology graduate student trained in delivering BA treatment.	Therapist's adherence to the intervention was rated as good (84%), and participants often did their homework (81%).	- / -	Moderate	GDS-S: Yes IG: 6.20 (±3.15) to 4.04 (±2.89 CG: 5.00 (±2.24) to 4.40 (±2.97) $F(2, 96) = 3.73$, $p = .03$, $\eta 2 = .07$

Note. - : no information available; PRN: pro re nata medication; IG: intervention group; CG: control group; NPI: Neuropsychiatric Inventory (total score = 70, a higher score indicates more different symptoms and greater number of severe symptoms present,[40]); NPI*: unclear which version of the NPI was used, total score may vary; CMAI: Cohen–Mansfield Agitation Inventory total score = 203, a higher score indicates more severe symptoms,[41]); ADCS-CGIC: Alzheimer's Disease Cooperative Study–Clinical Global Impression of Change (Changes in patients are rated in five domains on a seven-point rating scale,[34]); Self-made tool for agitation (total score 18, a higher score indicates more severe symptoms,[35]), Self-made tool for negative emotions (total score 24, a higher score indicates more severe symptoms,[35]); NRS-R: Neurobehavioral Rating Scale–Revised (29 items, total score 87, a higher score indicates more severe symptoms,[33]); GDS-S: Geriatric Depression Scale–Short Form (total score 15, a higher score indicates more severe symptoms[32];); p: p-value; d: effect size (Cohen's d); F: F-ratio; $\eta 2$: Eta-squared.

effectively reduce NPS seems to challenge nursing resources. Therefore, successful implementation of physical activity in daily nursing practice will have financial implications. On the other hand, we believe that daily physical activity, such as taking a walk outside, is not only a basic human need and right but also important for maintaining function in daily living.[36] Accordingly, it is also plausible that insufficient physical activity may be linked to behavioural crises. Therefore, daily physical activity should be an integral part of care during hospitalisation, especially in cases of behavioural crisis. Overstimulation was the only adverse event we identified in our systematic review, in the study that implemented physical exercise (and music sessions) at the ward level.[36] The authors suggested that interactive music interventions, such as singing, dancing or playing instruments, may have caused overstimulation. We found no other scientific literature that confirms that music interventions or other non-pharmacological interventions can cause overstimulation. Still, a systematic review of different music interventions, not limited to a specific setting but with most studies taking place in inpatient long-term care settings, found that receptive music interventions (e.g., listening to individualised music) reduced NPS in people with dementia, while interactive music interventions did not.[49] Therefore, listening to music seems to be a promising intervention to reduce NPS in patients with cognitive impairment hospitalised for behavioural crises. A low-quality study included in our review, found that listening to individualised music had significant positive effects on agitation and negative emotions.[35] Considering the cost and ease of implementation, in clinical practice this intervention would requires material resources, a music devices, and staff with the time and skills to prepare the individualised music that patients enjoy listening to.

Only one of the studies included in our systematic review activated patients' behaviour to do activities autonomously, planned with a therapist based on their life goals.[32] This moderate-quality study significantly reduced depressive symptoms, in patients with mild or moderate cognitive impairment. This suggests that non-pharmacological interventions need not be administered directly to patients or done with them but can also empower patients to do them themselves, at least in patients with mild to moderate cognitive impairment. If patients can engage themselves, this would reduce the workload on nursing staff. However, nursing staff would need to be equipped and trained in relevant communication skills[32] as this is a communication-based intervention.

Taken together, the interventions in the included studies of our systematic review focused on engaging patients in and maintaining (meaningful, physical or musical) activities. Engaging in (familiar) activities is a well-documented need for older adults with cognitive impairment[50] and mental illnesses,[51] what could be particularly important during hospitalisation for behavioural crises. Involuntary hospitalisation in an unfamiliar environment disrupts daily routines, which can lead to increased disorientation, insecurity and dependency. (Familiar) activities can provide (well-known) structure, orientation, and security, thereby fostering a sense of control and autonomy.[51,50] Whether engaging patients or supporting autonomous activities is more appropriate in reducing NPS may depend on the individual patient's cognitive resources and preferences. However, hospitalisation inherently increases dependency, thereby limiting both engagement in and the maintenance of autonomous activities. On the other hand, it is maybe characteristic for this setting, that nursing staff often face high workloads and may only be able to provide non-pharmacological interventions during brief periods, as they frequently (must) prioritise medical procedures and care routines.

By reviewing the included studies, we found some methodological challenges relevant to studies on how to prove the effectiveness of non-pharmacological interventions for patients with cognitive impairment hospitalised for behavioural crises. Similar challenges may arise when non-pharmacological interventions are provided in clinical practice. Using the NPI or the CMAI can be challenging due to the limited length of stay in hospital. These measures commonly assess the occurrence of behaviours during the previous two or four weeks.[52–54] For clinical trials in hospitals, this timeframe is often too long, as it would increase the attrition rate. Shortening this timeframe risks overlooking some NPS at admission when patients are not yet well known to staff, as well as rating symptoms differently at discharge, when patients are known better. Furthermore, they do not assess immediate or short-term effects, which are both likely and valuable when people engage in activities they enjoy. This may be even more important in interventions like occupational activities, as they may not be very different from standard care. Occupational interventions, such as activity therapy, are already part of standard care in geriatric psychiatric settings.[13] This could lead to the misconception that these interventions are not effective at reducing NPS. In addition, all included studies in our review measured the effect of a predefined intervention on a (or more) predefined outcome(s). The disadvantage is that the results are based on the average effect, and the varied positive effects of individual participants is lost. Patient-centred outcomes[55] and real-time momentary assessment by observations[56] may prompt more relevant outcomes for patients and further interesting findings on the effectiveness of non-pharmacological interventions. An alternative study design could be an N-of-1 design.[55] An N-of-1 design, especially suitable for investigating and heterogenous small samples because it focuses on individual-level analysis rather than group averages and allows that each participant acting as their own control.[57] It would allow measuring outcomes important to the patients or others (e.g. apathy and agitation), but also tailoring the interventions to the needs of individual patients (e.g. physical activity and individualised music interventions).[57] Tailoring the interventions to the needs of individual patients is a further important aspect to increase the effectiveness of non-pharmacological intervention.[58]

That we were only able to include five studies in our systematic review, suggests that there is a gap in research on non-pharmacological interventions applicable by nursing staff to reduce NPS in older patients with cognitive impairment hospitalised for behavioural crises. More research, including innovative high-quality RCTs with rigorous sampling methods and validated outcome measures are needed, to conclude about the effectiveness of non-pharmacological interventions for this specific scope. Patient-centred outcomes, real-time momentary assessment by observations and N-of-1 design could enhance the assessment of relevant outcomes for patients. Furthermore, future studies should focus more on implementing interventions that can be integrated into the daily care routines of nursing staff. Therefore, patient-related and contextual factors must be considered and reported, as well as factors relating to the process of implementation. This would improve understanding of the conditions under which non-pharmacological interventions are effective in reducing NPS in clinical practice.[59] Relevant contextual and patient-related factors, could be the nursing staff's high workloads and patients' disorientation, insecurity and agitation due to hospitalisation and the need for structure through activities (or occupation). On the other hand, successful implementation of non-pharmacological interventions in clinical practice seems to require that nursing staff be given sufficient time to deliver them.

Finally, the possibility of overstimulation should be considered in future studies and clinical practice, as patients may already have high stress levels due to hospitalisation for a behavioural crisis, leading to a need for calm and rest, and making them sensitive to overstimulation.[3]

Although, there seems to be broad agreement on the advantages of non-pharmacological interventions which is increasingly supported by evidence in other settings,[60] and they are recommended in

guidelines as a first-line treatment to reduce NPS,[19,20] we could only find a very limited evidence. We do not wish to claim that these interventions are not helpful for patients with NPS. Instead, we think it is important to adapt non-pharmacological interventions to individual patients' characteristics, context-specific factors, so that nursing staff can deliver them as a contribution to existing care practice.

Strengths and limitations

The value of this systematic review is that it summarises the current effectiveness of non-pharmacological interventions applicable by nursing staff in this specific setting and demonstrates the limited available evidence in the setting. Thereby, we used strict systematic procedures and the two authors' independent screening and assessment of the quality of the abstracts and full texts. This review also has some limitations. This is mainly due to the small number of studies of varying quality, the heterogeneity of interventions and outcome measures, but also possible publication bias or language bias, as our search was limited to publications in English and German. During the research process, we refined the search string by excluding some keywords and subject headings. This allowed for a strict application of the inclusion and exclusion criteria. In search of the best evidence and clear effects, we included only RCTs and non-RCTs and excluded educational and organisational interventions. This also may have influenced our ability to include only five trials.

Conclusions

The total identified studies were few, and they found heterogeneous results. Therefore, this review describes no strong evidence for non-pharmacological interventions applicable by nursing staff to reduce NPS in patients with cognitive impairments hospitalised for behavioural crises. The strongest evidence was found for physical exercise to reduce overall NPS. More research is needed to prove the effectiveness of non-pharmacological interventions to reduce NPS in older patients with cognitive impairment hospitalised for behavioural crises. The appropriateness and clinical effectiveness of intervention are likely to be influenced by context-specific factors and patient's characteristics, and existing care practices. Therefore, we recommend that these factors be considered (and reported) in future studies and clinical practice. Furthermore, especially in patients with cognitive impairment hospitalised for behavioural crises, the possibility of overstimulation should be considered.

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Declaration of generative AI in scientific writing

During the preparation of this work the authors used DeepL wite and Grammarly Desktop in order to to improve the English language. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Ethical statement

As this is a systematic review, we did not collect primary data.

Clinical trial registration

PROSPERO database (CRD42023433680)

Declaration of competing interest

None.

CRediT authorship contribution statement

Eliane Baumberger: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Simone Beeri:** Investigation, Formal analysis. **Stefan Klöppel:** Writing – review & editing, Supervision, Conceptualization. **Sandra Zwakhalen:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Sabine Hahn:** Writing – review & editing, Supervision, Methodology, Conceptualization.

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Supplementary materials

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