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## Outcomes tested in non-pharmacological interventions in MCI and early dementia: a scoping review

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3 **Outcomes tested in non-pharmacological interventions in MCI and early dementia: a**  
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6 **scoping review**  
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## Abstract

Objectives: Non-pharmacological treatments are an important aspect of dementia care. A wide range of interventions have been trialled for the early stages of dementia and mild cognitive impairment. However, the variety of outcome measures used in these trials makes it difficult to make meaningful comparisons. The objective of this study is to map which outcome measures are used in trials of non-pharmacological treatments in MCI and early dementia.

Design: Scoping Review

Data Sources: EMBASE, Psych Info, Medline and the Cochrane Register of Controlled Trials were searched from inception until February 2018. An additional search was conducted in April 2019

Eligibility: We included RCTs testing non-pharmacological interventions for people diagnosed with MCI or early-stage dementia. Studies were restricted to full RCTs; observational, feasibility and pilot studies were not included.

Charting Methods: All outcome measures used by included studies were extracted and grouped thematically. Trends in the types of outcome measures used were explored by type of intervention and over time.

RESULTS: 92 studies were included in this review. We extracted 361 individual outcome measures, of which 78 (22%) were used more than once. Cognitive measures were the most frequently used, with the MMSE being the most popular.

Conclusions: Our findings highlight an inconsistency in the use of outcome measures. Cognition has been prioritised over other domains, despite previous research highlighting the importance of quality of life and caregiver measures. To ensure a robust, globally applicable evidence base, more research is needed to highlight which outcome measures should be used over others.

Protocol Registration: The protocol for this study was registered on PROSPERO (ID: CRD42018102649).

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3 **Word count: 3,519**  
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9 **Strengths and Limitations of this study:**  
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- 11
- 12 • This scoping review has systematically mapped which outcome measures have been used by  
13 randomised controlled trials testing non-pharmacological treatments in early dementia and  
14 mild cognitive impairment.  
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16
  - 17 • This is the first review to explore the broader trends in the use of outcome measures in this  
18 area of work.  
19  
20
  - 21 • The papers included in this review were limited to full randomised controlled trials, other  
22 study designs may be using different types of outcome measures.  
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24
  - 25 • Further research is needed to establish which measures should be used over others.  
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## Introduction

Delivery of treatment in the early stages of dementia has been identified as a global priority<sup>1,2</sup>.

Current pharmacological treatments for the cognitive symptoms of dementia have been found to have greater effect when delivered as early as possible<sup>3</sup> however, the benefits of delivering non-pharmacological treatments early are less well understood. Non-pharmacological treatments are an important clinical tool for managing dementia as they are more acceptable to some and less prone to side effects, making them a safe alternative to drug treatments<sup>4</sup> Those diagnosed earlier in the disease have more cognitive abilities available to engage with non-pharmacological treatments and bolster their own methods for coping with the disease<sup>5</sup>. Previous systematic reviews have found non-pharmacological treatments can improve outcomes; however, these reviews were restricted to a small number of outcome measures<sup>6,7</sup>.

Mild cognitive impairment (MCI) has been identified as a potential prodrome for dementia, with approximately 10% of people with MCI converting to a diagnosis of dementia<sup>8</sup>. There is an interest in MCI, as a diagnosis of MCI can facilitate an early diagnosis of dementia and therefore earlier access to dementia services and treatment<sup>9</sup>. MCI is a potentially reversible condition, with many people with MCI reverting back to normal levels of cognition<sup>9</sup> therefore, it is important treatments are available. However, it is not clear which treatments can reverse MCI or prevent conversion to dementia<sup>3</sup>. No drug treatments for MCI have been found to be effective<sup>10,11</sup> and acetylcholinesterase inhibitors are not recommended however, there is some limited evidence that non-pharmacological interventions may be beneficial<sup>3,12</sup>.

Randomised Controlled Trials (RCTs) testing non-pharmacological treatments in dementia and MCI are becoming more common. However, they are highly heterogeneous in terms of participants recruited, quality of the study and the types of interventions they are testing, making it difficult to establish the effectiveness of one treatment over another<sup>6,12</sup>. Compounding these issues is the inconsistent use of outcome measures in this area of work<sup>9,13</sup>.

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3 Systematic reviews have identified possible benefits of non-pharmacological treatment, yet meta-  
4 analyses are difficult to conduct due to the variation in outcome measures used by studies and  
5 typically yield small to moderate effect sizes <sup>6 7</sup>. It is possible that these small effect sizes are due to  
6 the selection of outcome measures which either lack sensitivity or the change following the  
7 intervention not being in the area covered by the outcome measure. It is important researchers are  
8 clear on which domains their interventions are targeting, and which measures are best able to  
9 capture this change <sup>14</sup>. As non-pharmacological treatments become more effective, there needs to  
10 be a more coherent use of outcome measure internationally to ensure a broad and robust evidence  
11 base <sup>14</sup>.

12  
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14 In 2008, the INTERDEM group, a consortium of dementia researchers across Europe, did work to  
15 draw a consensus on which outcome measures should be used when evaluating non-  
16 pharmacological treatments. They recommended 22 measures across nine domains including quality  
17 of life, mood, global functioning, behaviour, daily living skills, caregiver mood, caregiver burden and  
18 staff morale <sup>14</sup>. This guidance does not explore outcomes by the stage of the disease. Furthermore,  
19 the outcome measures were selected based on their applicability to European research, it is  
20 important to have consistency in outcome measures globally.

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23 It is not understood which outcome measures are currently being used in non-pharmacological  
24 treatments for early dementia and MCI. Scoping reviews present the opportunity to map the  
25 evidence on a topic <sup>15</sup>, unlike a systematic review scoping reviews can be used to summarise the  
26 evidence in a heterogeneous body of literature. Therefore, the aim of this scoping review is to map  
27 which outcome measures are being used in RCTs for non-pharmacological treatments in MCI and  
28 early dementia.

### 29 *Objectives*

30  
31 The specific objectives of this scoping review are to:



- (1) Chart which outcomes measures have been used to assess the effectiveness of nonpharmacological treatments in early dementia and MCI
- (2) Highlight which types of measures have been used most frequently
- (3) Explore whether the outcome measures used differ depending on the type of intervention being tested

## Methods

### *Protocol registration*

The protocol for this review was developed following the guidelines set out by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension (PRISMA) statement<sup>16</sup> and the PRISMA guidelines for Scoping Reviews (PRISMA-ScR)<sup>15</sup>. The protocol was registered prospectively on PROSPERO (ID: CRD42018102649).

### *Eligibility criteria*

We included RCTs testing non-pharmacological interventions for people diagnosed with MCI or early-stage dementia. Studies were restricted to full RCTs; observational, feasibility and pilot studies were not included.

Studies were included if they met the following criteria:

- Testing non-pharmacological interventions. Studies were not excluded if participants were also treated with acetylcholinesterase inhibitors
- Participants had a diagnosis of MCI or early-stage dementia, which either met standardised diagnostic criteria, such as the International Statistical Classification of Diseases (ICD-10) or The Diagnostic Statistical Manual of Mental Disorders (DSM); or was defined by a standardised clinical measure, such as the Mini-Mental State Exam (MMSE), the Clinical Dementia Rating (CDR) or the Global Deterioration Scale (GDS). Studies which include a mix of participants with early dementia and MCI were included, however, studies which included

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3 healthy participants and participants with dementia at both at the later stages of the disease  
4  
5 were excluded.

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- 8 • The intervention was targeted for the person living with dementia or MCI. Dyadic  
9  
10 interventions, interventions delivered to both the person living with dementia and their  
11  
12 caregivers, were included, however, interventions delivered solely to caregivers or health  
13  
14 care professionals were excluded.
  - 15  
16 • Participants were living in care homes or the community
  - 17  
18 • Written in English
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22 Studies were excluded if:

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- 25 • Only pharmacological interventions were tested
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27 • The participants were diagnosed with vascular cognitive impairment or young onset  
28  
29 dementia as they have a different trajectory of decline
  - 30  
31 • Participants were living in a psychiatric inpatient or acute hospital setting
  - 32  
33 • The intervention had the primary aim of treating depression
  - 34  
35 • The study tested palliative care interventions or advanced care planning
  - 36  
37 • The only outcome measure were economic outcomes, such as cost effectiveness etc.
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#### 41 *Information sources and search strategy*

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44 To identify potentially relevant studies, we searched EMBASE, Psych Info, Medline and the Cochrane  
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46 Register of Controlled Trials from inception until 22<sup>nd</sup> February 2018, an additional search was  
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48 conducted on 2<sup>nd</sup> April 2019. See **Table A.1** for the final search strategy for MEDLINE, which was  
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50 adapted for the other databases. The final search results were exported into EndNote where  
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52 duplicates were removed.

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56 Additional papers were identified by searching the references of included papers and other  
57  
58 systematic reviews. Conference abstracts and publications were not included.  
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### *Selection of sources of evidence*

Study selection was managed in Rayyan, where citations were screened against the inclusion and exclusion criteria. Rayyan is an online app for systematic reviews which allows researchers to create their own coding system for decision making<sup>17</sup>. References were first screened by title and abstract, followed by a full-text screening. A second reviewer (MC) screened 10% of the articles at each stage of the review. Disagreements were resolved by discussions with a third reviewer (MP).

A critical appraisal or assessment of the risk of bias is not necessary for a scoping review<sup>15</sup>. This scoping review is not aiming to critically appraise the cumulative literature of outcome measures for early non-pharmacological treatment in dementia, therefore we did not conduct a critical appraisal or risk of bias assessment for this review.

### *Data charting process and data items*

Data from eligible studies were charted using a standardised extraction tool designed for this study. Items deemed most relevant to the review objectives were the diagnosis of the study participants, description of interventions being tested, the number of intervention groups, and outcome measures used with references.

### *Synthesis of results*

The charted data were mapped to reflect the objectives of this review. Following data charting, outcome measures which used more than once across the included studies were grouped by domain, we grouped the interventions thematically by the type of intervention being tested.

We explored which types of outcome measures were used by intervention type, by tabulating the type of intervention against the domain of the outcome measure. We excluded interventions which were only used once from this summary. Results were presented in tables and summarised narratively.

### *Patient and Participant Involvement*

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3 The South London and Maudsley MALADY group, of current and former carers of people living with  
4 dementia, were consulted in the planning of this study.  
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## 8 **Results**

### 9 *Included studies*

10  
11 After duplicates were removed, a total of 7,056 citations were screened for inclusion, 653 were  
12 screened at full text and 76 papers were initially identified. A top-up search in April 2019 identified  
13 119 new citations, 18 were included making the total number of included studies 92, See **Figure 1**.  
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20 The studies included in this review are described in **Table 1**, including diagnosis of included  
21 participants, number of intervention groups, details on the interventions and comparisons tested  
22 and the number of outcomes measured used. The included studies were published between 2002  
23 and 2019.  
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30 The majority of studies included in this review were conducted in the USA (n=11) followed by Hong  
31 Kong (n=10), Italy (n=10), mainland China (n=7), Japan (n=7), and South Korea (n=7). Studies were  
32 also conducted in: Argentina, Australia, Brazil, Canada, Czech Republic, Denmark, France, Finland,  
33 Germany, Greece, Hungary, Iran, Norway, Pakistan, Singapore, Spain, Taiwan, The Netherlands,  
34 Turkey, and the United Kingdom; these countries had fewer than 5 included studies.  
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42 Most studies only recruited participants with MCI (n=73), followed by early-stage dementia only  
43 (n=15), and six studies recruited both participants with MCI and early-stage dementia.  
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### 48 *Results of individual sources of evidence*

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50 We extracted 361 individual outcome measures from the included studies, of these 78 (22%) were  
51 used more than once. Out of the 78 measures used more than once, 70 (88%) were measures of  
52 participants living with dementia (PLWD), 6 measures were used in both the PLWD and their  
53 caregiver, 2 measures were only of the caregiver. The number of outcome measures used by each  
54 study ranged between one and 21 with an average of 6.85.  
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### *Types of non-pharmacological interventions*

We grouped the interventions thematically by type. The most frequently tested type of intervention was cognitive training (n=37) followed by physical activity (n=25), combined physical activity and cognitive training (n=4), multicomponent psychosocial interventions (n=4) and support groups (n=3). Animal-assisted therapies, art-based therapies, case management, Chinese calligraphy, music-based interventions and reminiscence therapy were each tested in two studies.

A group weight loss programme, mindfulness, social activities, transcranial direct current stimulation (TDS), transcutaneous electrical nerve stimulation (TENS), and Transcranial magnetic stimulation (TMS) were each trialled once. These interventions were not included in the analysis of trends in outcome measures.

### *PLWD outcome measures*

**Table 2** presents the PLWD specific outcome measures grouped by domain. The most frequently measured domain in PLWD was cognition/memory, which was measured 219 times across the 93 included studies. The most frequent measure of cognition was the MMSE, which was measured 37 times. In addition to measures of memory performance knowledge of memory strategies was measured 3 times in PLWD.

The next most frequently measured domain in PLWD was behavioural and psychological symptoms of dementia (BPSD), within this depression was the most commonly measured BPSD. The Geriatric Depression Scale was the most used measure in this domain, followed by the Neuropsychiatric Inventory which examines a greater number of symptoms. Other BSPDs measured were apathy and agitation resulting from memory problems.

Quality of life and wellbeing were measured 15 times across the included study. Quality of life was measured 15 times using four different instruments, the most popular of which was Logsdon's Quality of Life in Alzheimer's disease scale which was used seven times.

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3 Measures of everyday living, physical ability, biological outcomes and adherence to the intervention  
4 delivered in the study were measured less than 20 times across the included studies.  
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### 7 8 *Caregiver measures* 9

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11 Eight interventions in this study were dyadic<sup>18-25</sup>, all included outcome measures specific to the  
12 caregiver in addition to the PLWD. One study of an intervention solely delivered to the PLWD also  
13 included a caregiver specific measure<sup>26</sup>.  
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18 **Table 2** also presents the outcome measures administered to caregivers grouped by domain. The  
19 Center for Epidemiological Studies Depression Scale and the Zarit Caregiver Burden interview were  
20 the only measures which were administered solely to caregivers. The other caregiver measures were  
21 also administered to PLWD. The most frequently measured domain in caregivers was depression,  
22 followed by caregiver burden. General wellbeing, knowledge of memory strategies, quality of life  
23 and stress were each measured once.  
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### 26 27 28 29 30 31 32 33 *Use of outcome measures over time* 34

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36 Randomised controlled trials of non-pharmacological treatments in early dementia and MCI have  
37 become more frequent over recent years. Almost half (48%) of studies included in this review were  
38 published between 2016 and 2018.  
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43 **Figure 2** charts the use of outcome measures domains over time. As the number of studies in this  
44 area has increased over time, so too has the use of outcome measures in all domains.  
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47 Cognition/memory has consistently been measured over other domains from the beginning of this  
48 sample. The only noticeable trend change is in measures of BPSD, which was generally in line with  
49 other domains until around 2012, where it overtakes other domains.  
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54 Nearly all studies in 2014 included a measure of everyday living, however, since then, the number of  
55 studies including these measures have declined. Where measures of everyday living are being used  
56 less, measures of BPSD are being used more.  
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3 Similarly, caregiver measures were consistently used until 2011, where in 2010 and 2011 all studies  
4 included a caregiver measure, however since then the use of such measures has declined.  
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#### 8 *Use of outcome measures by intervention*

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11 **Table 3** presents diagnosis and type of intervention by the domains measured. Cognition/memory  
12 was the most measured domain across all diagnostic groups, followed by BPSD. The next most  
13 common domain measured for studies of people with dementia was caregiver specific measures,  
14 whereas in MCI it was physical performance.  
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20 Cognition/memory was measured in all types of intervention. BPSD was measured in all types of  
21 interventions except for combined cognitive and physical training interventions but was particularly  
22 favoured by studies testing cognitive training and psychosocial interventions. Quality of life was  
23 measured by studies of case management, cognitive training, psychosocial interventions, physical  
24 activity and support groups.  
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31 Caregiver measures were used in five types of interventions. Case management, cognitive training  
32 and psychosocial interventions; followed by arts-based therapy and support groups.  
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#### 38 **Discussion**

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40 In this study, we used a scoping review to map which outcome measures had been used in trials for  
41 non-pharmacological treatments of early dementia and MCI. We extracted 361 individual outcome  
42 measures used in 92 trials, only 22% of which were used more than once. We grouped the outcome  
43 measures which had been used more than once and examined differences in their use over time, by  
44 diagnostic group and by the type of intervention they were being used to evaluate. Measures of  
45 cognition and BPSDs were the most frequently used across all studies and types of intervention.  
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54 Perhaps unsurprisingly, measures of cognition or memory are the most prevalent across all  
55 diagnostic groups and types of intervention with the MMSE being the most frequently used outcome  
56 measure, despite the ADAS-cog having been validated as the gold-standard measure of cognition <sup>14 27</sup>  
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3 28. Measuring cognition is central to measuring the progression of dementia and is clinically and  
4 empirically useful outcome to measure in dementia research <sup>28</sup>, however, in this review, we charted  
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6 40 different measures of cognition. This indicates that while cognition has been prioritised as an  
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8 outcome in studies of non-pharmacological interventions, there is no consensus between  
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10 researchers on which specific measures should be used. In addition to measures of cognitive  
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12 performance, three studies have also measured participants knowledge or retention of memory  
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14 strategies, indicating an interest in longer-term coping strategies for memory loss.  
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19 Measures of the BPSD have become more common over time, becoming in 2017 the most measured  
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21 outcome after cognition. There is not much variety in the BPSDs which have been measured.  
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23 Generally, depression was measured over other BPSDs. Other BPSDs such as agitation were  
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25 measured less, perhaps because they are more associated with the later stages of the disease and  
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27 depression is associated with the earlier stages <sup>29</sup>.  
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31 Quality of life and wellbeing was not amongst the most measured domains. Four measures of quality  
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33 of life were used 13 times across the included studies, all but one of these measures were dementia  
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35 specific measures. It is surprising quality of life has not been measured more, as previous research  
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37 has stated that in the absence of a cure, health care providers have a greater ability to improve  
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39 quality of life than alter the progression of the disease <sup>30</sup>. Furthermore, in a priority setting exercise  
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41 in people diagnosed with MCI and their caregivers, both people with MCI and caregivers rated  
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43 quality of life of the patient as the most important outcome to measure, followed by caregiver  
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45 quality of life/burden <sup>31</sup>. Indicating while quality of life has been identified as a priority by PLWD, MCI  
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47 and their caregivers in previous research, the findings of this study shows this is not being translated  
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49 into trials of non-pharmacological treatments for early dementia and MCI.  
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54 Likewise, caregiver measures had consistent low use across the studies included in this review. We  
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56 charted eight caregiver measures which were used 11 times across the included studies. Caregiver  
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58 measures were more commonly used in studies of PLWD, rather than MCI. Previous research has  
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3 highlighted the profound effect of the disease on their caregivers, with around half of caregivers  
4 experiencing high levels of burden <sup>32</sup>. However, a third of caregivers of people with MCI also report  
5 extreme levels of burden <sup>33</sup>, yet the findings of this study show this is less investigated.  
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10 There was a lot of variability in the types of outcome measures being used to evaluate the different  
11 types of intervention. All studies measured cognition and all but one measured BPSD. Outcome  
12 measures should be selected depending on the domains the intervention is seeking to address <sup>28</sup>  
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18 In 2008, the INTERDEM group recommended 22 outcome measures for use across nine domains <sup>14</sup>.  
19 We found 11 of these 22 measures (50%) were used by the studies included in this review, one of  
20 the recommended domains (staff carer morale) was not applicable to the studies included in this  
21 review. All measures recommended for measuring patient mood, patient quality of life and patient  
22 quality of life were charted in this review. Only one of the recommended measures for the activities  
23 of daily living, caregiver mood, caregiver burden and caregiver quality of life domains were charted  
24 and no measures under the global measures domain were charted in this review. This indicates that  
25 there is some consistency between which measures are recommended and which measures are  
26 utilised, this is largely for patient measures and there is less consistency for caregiver measures.  
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### 39 *Limitations*

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41 The findings of this review must be interpreted in the context of the study. To make this review  
42 feasible we only included full RCTs, other outcome measures may have been used in different types  
43 of studies. Furthermore, only outcome measures which were published could be included in this  
44 review. The studies included in this study were heterogeneous in terms of participants recruited,  
45 interventions tested, and outcome measures used, making it difficult to group them thematically. It  
46 is possible some nuance is lost in the exploration of broader themes. As with the nature of scoping  
47 reviews, we are only able to present which outcome measures have been used in previous research,  
48 we are unable to draw conclusions as to which outcome measures should be used over others.  
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### *Implications and recommendations for future research*

The findings of this review indicate there is very little consistency in outcome measures used in RCTs for non-pharmacological interventions in MCI and early dementia, however we are not able to conclude which measures should be used over others. To create a strong, global evidence base for non-pharmacological treatments more research, with the involvement of PLWD and their carers, is needed to determine which measures are preferable over a greater number of domains. Additionally, the prevalence of cognitive measures found in this study, suggests that researchers are including such measures because there is an expectation to do. Researchers should be clear on the theory behind how their intervention creates change and use the appropriate outcome measures.

### **Conclusions**

In summary, this study has found RCTs for non-pharmacological treatments in early dementia and MCI use a broad range of outcome measures, with a small proportion being used more than once. Excepting measures of cognition, there is very little commonality between studies. Where previous research has set priorities on outcome measures preferred by PLWD, people with MCI and caregivers, quality of life for example, this has not yet translated into studies measuring new treatments. Further research to understand which outcomes should be prioritised and how they should be measured.

### **Contributors**

EC designed the study, carried out the literature review, the data charting and synthesis, data interpretation, article preparation, article review and correspondence. AMP and VL contributed to the study design, data interpretation, and article review. MC contributed to the data charting.

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**Competing interests**

None declared

For peer review only

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**Table A1. Search Strategy for OVID**

<b>Search term</b>	<b>Search term continued</b>
<b>1</b> Early dementia	<b>39</b> self help group
<b>2</b> Mild dementia	<b>40</b> psychotherapy
<b>3</b> mild alzheimer*	<b>41</b> CBT
<b>4</b> early alzheimer*	<b>42</b> Cognitive behavio?ral therap*
<b>5</b> cognitive impairment	<b>43</b> Cognitive behavioural therap*
<b>6</b> age related cognitive impairment	<b>44</b> Talking therap*
<b>7</b> Mild cognitive impairment	<b>45</b> Individual therap*
<b>8</b> MCI	<b>46</b> Peer support
<b>9</b> mild neurocognitive disorder	<b>47</b> Counselling
<b>10</b> <b>1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9</b>	<b>48</b> Communication
<b>11</b> cognitive training	<b>49</b> acupuncture therap*
<b>12</b> brain training	<b>50</b> acupuncture
<b>13</b> memory training	<b>51</b> acupuncture points
<b>14</b> Behavio?r therap*	<b>52</b> Transcranial Magnetic Stimulation
<b>15</b> Behavio?r modification	<b>53</b> TMS
<b>16</b> pleasant activit*	<b>54</b> Relaxation therap*
<b>17</b> Cognitive stimulation therapy	<b>55</b> Therap* relaxation
<b>18</b> CST	<b>56</b> Relaxation techniques
<b>19</b> Transcutaneous Electrical Nerve Stimulation	<b>57</b> Early intervention
<b>20</b> TENS	<b>58</b> Alternative therap*
<b>21</b> Exercise	<b>59</b> <b>11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 19 OR 20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28 OR 29 OR 30 OR 31 OR 32 OR 33 OR 34 OR 35 OR 36 OR 37 OR 38 OR 39 OR 40 OR 41 OR 42 OR 43 OR 44 OR 45 OR 46 OR 47 OR 48 OR 49 OR 50 OR 51 OR 52 OR 53 OR 54 OR 55 OR 56 OR 57 OR 58 OR 59</b>
<b>22</b> exercise therap*	<b>60</b> randomized controlled trial
<b>23</b> Walking	<b>61</b> randomised controlled trial
<b>24</b> music therap*	<b>62</b> RCT
<b>15</b> reminiscence therap*	<b>63</b> Clinical Trial
<b>26</b> massage therap*	<b>64</b> intervention
<b>27</b> therap* touch	<b>65</b> <b>60 OR 61 OR 62 OR 63 OR 64 OR 65</b>
<b>28</b> recreation therap*	<b>66</b> early dementia
<b>29</b> light therap*	<b>67</b> mild dementia
<b>30</b> therap* light	<b>68</b> mild alzheimer*
<b>31</b> sensory stimulation	<b>69</b> early alzheimer*
<b>32</b> multisensory stimulation	<b>70</b> cognitive impairment
<b>33</b> complementary therap*	<b>71</b> age related cognitive impairment
<b>34</b> aromatherapy	<b>72</b> Mild cognitive impairment
<b>35</b> support group	<b>73</b> MCI
<b>36</b> therap* group	<b>74</b> mild neurocognitive disorder
<b>37</b> memory group	<b>75</b> <b>66 OR 67 OR 68 OR 69 OR 70 OR 71 OR 72 OR 73 OR 74 OR 75</b>
<b>38</b> self help	<b>76</b> <b>10 AND 59 AND 75</b>

Table 1. Included Studies

Lead Author	Year	Country	Diagnosis	Number of Groups	Group 1	Group 2	Group 3	Group 4	Group 5	Number of measures
Amjad <sup>34</sup>	2019	Pakistan	MCI	2	Aerobic Exercise	Non-Aerobic Exercise	-	-	-	4
Bae <sup>35</sup>	2019	Japan	MCI	2	Multi-Intervention Programme	Active Control	-	-	-	10
Baker <sup>36</sup>	2010	USA	MCI	2	Aerobic Exercise	Stretching	-	-	-	11
Belleville <sup>37</sup>	2018	Canada	MCI	3	Cognitive Training	Psychosocial Intervention	Control	-	-	7
Biasutti <sup>38</sup>	2017	Italy	MCI	2	Cognitive Training	Gym Activities	-	-	-	4
Bono <sup>39</sup>	2015	Italy	MCI	2	Animal Assisted Therapy	Control	-	-	-	4
Burgio <sup>40</sup>	2018	Italy	MCI	2	Numerical Training	Executive Training	-	-	-	13
Buschert <sup>41</sup>	2012	Germany	MCI	2	Cognitive Training	Active Control	-	-	-	5
Carretti <sup>42</sup>	2013	Italy	MCI	2	Cognitive Training	Active Control	-	-	-	16
Cavallo <sup>43</sup>	2016	Italy	Dementia	2	Cognitive Training	Active Control	-	-	-	3
Chan <sup>44</sup>	2016	Hong Kong	MCI	2	Chinese Calligraphy	Computer Activities	-	-	-	13
Chan <sup>45</sup>	2017	Hong Kong	MCI	2	Chinese Calligraphy	Computer Activities	-	-	-	8
Choi <sup>46</sup>	2018	South Korea	MCI	2	Ground Kayaking	Home Exercise Education	-	-	-	7
Combourieu Donnezan <sup>47</sup>	2018	France	MCI	4	Physical Training	Cognitive Training	Simultaneous Cognitive and Physical Training	Control	-	4
DiNapoli <sup>48</sup>	2016	USA	MCI	2	Individualised Social Activities	Control	-	-	-	4
Doi <sup>49</sup>	2013	Japan	MCI	2	Exercise	Active Control	-	-	-	4
Doi <sup>50</sup>	2017	Japan	MCI	3	Dance	Playing Musical Instruments	Health Education Group	-	-	4
Drumond Marra <sup>51</sup>	2015	Brazil	MCI	2	TMS	Sham TMS	-	-	-	6
Emsaki <sup>52</sup>	2017	Iran	MCI	2	Cognitive Training	Active Control	-	-	-	9
Eyre <sup>53</sup>	2017	USA	MCI	2	Yoga	Cognitive Training	-	-	-	10
Feng <sup>54</sup>	2018	China	MCI	2	Single Component Cognitive Training	Multiple Component Cognitive Training	-	-	-	3
Fernandez-Calvo <sup>55</sup>	2015	Spain	Dementia	2	Multi-Intervention Programme	Control	-	-	-	21
Fiatarone Singh <sup>56</sup>	2014	Australia	MCI	4	Progressive resistance training and sham cognitive training	Progressive resistance training and cognitive training	Cognitive training	Control	-	12

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3	Finn <sup>57</sup>	2015	Australia	MCI	2	Repetition-lag Training	Control	-	-	-	6
4	Fogarty <sup>58</sup>	2016	Canada	MCI	2	Memory Intervention	Memory Intervention	-	-	-	5
5						Program and Tai Chi	Program				
6	Forster <sup>59</sup>	2011	Germany	Both	2	Cognitive Training	Control	-	-	-	10
7	Galante <sup>60</sup>	2007	Italy	Dementia	2	Cognitive Training	Active Control	-	-	-	12
8	Greenaway <sup>18</sup>	2013	USA	MCI	2	Memory Support System	Memory Support System	-	-	-	15
9						(Memory Rehabilitation)	without Training				
10						with Training					
11	Hagovska <sup>61</sup>	2017	Czech	MCI	2	Cognitive Training	Cognitive Training	-	-	-	0
12			Republic			(Computer Based)					
13	Hagovska <sup>62</sup>	2016	Czech	MCI	2	Cognitive Training and	Balance Training	-	-	-	4
14			Republic			Dynamic Balance Training					
15	Han <sup>63</sup>	2017	South Korea	MCI	2	Ubiquitous Spaced Retrieval-	Control	-	-	-	4
16						based Memory					
17						Advancement and					
18						Rehabilitation Training					
19	Han <sup>64</sup>	2017	South Korea	Both	2	Multimodal Cognitive	Active Control	-	-	-	7
20						Enhancement Therapy					
21	Hattori <sup>26</sup>	2011	Japan	Dementia	2	Art Therapy	Active Control	-	-	-	4
22	Ho <sup>65</sup>	2018	Hong Kong	Both	3	Dance Movement Therapy	Physical Exercise	Control	-	-	7
23	Horie <sup>66</sup>	2016	Brazil	MCI	2	Group Weight Loss	Control	-	-	-	10
24						Programme					
25	Hyer <sup>67</sup>	2016	USA	MCI	2	Cognitive Training	Active Control	-	-	-	3
26						(Computer Based)					
27	Jansen <sup>19</sup>	2011	The	Dementia	2	Case Management	Control	-	-	-	5
28			Netherlands								
29	Jean <sup>68</sup>	2010	Canada	MCI	2	Cognitive Training	Active Control	-	-	-	10
30	Jelcic <sup>69</sup>	2012	Italy	Dementia	2	Lexical-Semantic Treatment	Cognitive Stimulation	-	-	-	11
31	Jeong <sup>70</sup>	2016	South Korea	MCI	2	Cognitive Intervention	Cognitive Intervention	-	-	-	8
32						(Group based)	(Home Based)				
33	Kinsella <sup>20</sup>	2009	Australia	MCI	2	Cognitive Intervention	Control	-	-	-	4
34	Kohanpour <sup>71</sup>	2017	Iran	MCI	4	Aerobic Exercise	Lavender Extract	Aerobic Exercise and	Control	-	14
35								Lavender Extract			
36	Koivisto <sup>21</sup>	2016	Finland	Dementia	2	Psychosocial Intervention	Control	-	-	-	7
37	Kovacs <sup>72</sup>	2013	Hungary	MCI	2	Multimodal Exercise	Control	-	-	-	1
38	Kuster <sup>73</sup>	2016	Germany	MCI	3	Cognitive Training	Physical Training	Control	-	-	7
39	Kwok <sup>74</sup>	2012	Hong Kong	MCI	2	Cognitive Training	Active Control	-	-	-	5
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3	Lam <sup>75</sup>	2012	Hong Kong	MCI	2	Tai Chi	Stretching	-	-	-	-	4
4	Lam <sup>76</sup>	2015	Hong Kong	MCI	4	Cognitive Training	Cognitive and Physical Training	Physical Training	Social Groups	-	-	2
5												
6	Lam <sup>22</sup>	2010	Hong Kong	Dementia	2	Case Management	Control	-	-	-	-	2
7	Langoni <sup>77</sup>	2019	Brazil	MCI	2	Group Exercise	Control	-	-	-	-	14
8	Law <sup>78</sup>	2014	Hong Kong	MCI	2	Functional Tasks Exercise Programme	Cognitive Training	-	-	-	-	7
9												
10	Lazarou <sup>79</sup>	2017	Greece	MCI	2	Ballroom Dancing	Control	-	-	-	-	5
11	Li <sup>80</sup>	2019	China	MCI	2	Computerised Cognitive Training	Control	-	-	-	-	4
12												
13	Lim <sup>81</sup>	2018	Singapore	MCI	2	Mindfulness	Health Education	-	-	-	-	5
14	Logsdon <sup>23</sup>	2010	USA	Dementia	2	Early Stage Memory Loss Support Group	Control	-	-	-	-	10
15												
16	Luijpen <sup>82</sup>	2005	The Netherlands	MCI	2	TENS	Sham TENS	-	-	-	-	6
17												
18	Maffei <sup>83</sup>	2017	Italy	MCI	2	Multidomain Training	Control	-	-	-	-	10
19	Manav <sup>84</sup>	2019	Turkey	Dementia	2	Reminiscence Therapy	Social Interview	-	-	-	-	6
20												
21	Melendez <sup>85</sup>	2015	Spain	Both	2	Reminiscence Therapy	Control	-	-	-	-	6
22	Nagamatsu <sup>86</sup>	2012	Canada	MCI	2	Aerobic Exercise	Resistance Training	-	-	-	-	13
23	Olsen <sup>87</sup>	2016	Norway	Both	2	Animal Assisted Therapy	Control	-	-	-	-	9
24	Pantoni <sup>88</sup>	2017	Italy	MCI	2	Attention Process Training	Control	-	-	-	-	4
25	Park <sup>89</sup>	2018	South Korea	MCI	2	Cognition specific computer training	Non-specific computer training	-	-	-	-	5
26												
27	Poinsatte <sup>90</sup>	2019	USA	MCI	2	Aerobic Exercise	Stretching	-	-	-	-	3
28	Pongan <sup>91</sup>	2017	France	Dementia	2	Choral Singing	Painting	-	-	-	-	14
29	Poptsi <sup>92</sup>	2018	Greece	MCI	5	Paper Language Tasks	Computer Language Tasks	Oral Language Tasks	Active Control	-	-	4
30												
31	Qi <sup>93</sup>	2019	China	MCI	2	Aerobic Exercise	Control	-	-	-	-	3
32	Rapp <sup>94</sup>	2002	USA	MCI	2	Memory Enhancement Training (Multi-Component)	Control	-	-	-	-	9
33												
34												
35	Rojas <sup>95</sup>	2013	Argentina	MCI	2	Cognitive Intervention	Control	-	-	-	-	8
36	Rozzini <sup>96</sup>	2007	Italy	MCI	2	Cognitive Training and AChEIs	AChEIs	-	-	-	-	7
37												
38	Savulich <sup>97</sup>	2017	UK	MCI	2	Cognitive Training	Control	-	-	-	-	9
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3	Scherder <sup>98</sup>	2010	The Netherlands	MCI	3	Walking	Hand and Face Exercises	Control	-	-	-	11
4												
5	Shimada <sup>99</sup>	2017	Japan	MCI	2	Physical and Cognitive Training	Health Education Group	-	-	-	-	7
6												
7	Shimizu <sup>100</sup>	2017	Japan	MCI	2	Movement Music Therapy	Single Training Task	-	-	-	-	4
8	Simon <sup>101</sup>	2018	Brazil	MCI	2	Memory Training	Active Control	-	-	-	-	8
9	Song <sup>102</sup>	2019	China	MCI	2	Aerobic Exercise	Active Control	-	-	-	-	4
10	Suzuki <sup>103</sup>	2012	Japan	MCI	2	Multicomponent Exercise Group	Active Control	-	-	-	-	6
11												
12	Tappen <sup>24</sup>	2014	USA	Both	2	Cognitive Training (Home Based)	Life Story Interview	-	-	-	-	11
13												
14	Troyer <sup>104</sup>	2008	Canada	MCI	2	Multicomponent Intervention	Control	-	-	-	-	6
15												
16	Tsai <sup>105</sup>	2018	Taiwan	MCI	3	Aerobic Exercise	Resistance Training	Control	-	-	-	7
17	Tsantali <sup>106</sup>	2017	Greece	Dementia	3	Cognitive Training	Cognitive Stimulation	Control	-	-	-	5
18	Valdes <sup>107</sup>	2019	USA	MCI	2	Speed Processing Training	Active Control	-	-	-	-	2
19	van Uffelen <sup>108</sup>	2007	The Netherlands	MCI	4	Walking	Placebo Activity	Folic Acid/Vitamin B Supplements	Placebo Pills	-	-	3
20												
21	Waldorff <sup>25</sup>	2012	Denmark	Dementia	2	Multifaceted Counselling, Education and Support	Control	-	-	-	-	2
22												
23	Wei <sup>109</sup>	2014	China	MCI	2	Handball Training	Control	-	-	-	-	8
24	Yang <sup>110</sup>	2016	USA	MCI	2	Memory Enhancement Training	Yoga	-	-	-	-	3
25												
26	Yoon <sup>111</sup>	2017	South Korea	MCI	2	High-Speed Power Strength Training	Low-Speed Strength Training	-	-	-	-	5
27												
28	Young <sup>112</sup>	2014	Hong Kong	Dementia	2	Support Groups	Control	-	-	-	-	4
29	Young <sup>113</sup>	2017	Hong Kong	MCI	2	Holistic Health Group	Control	-	-	-	-	4
30	Yun <sup>114</sup>	2016	South Korea	MCI	2	TDS	Sham TDS	-	-	-	-	1
31	Zhao <sup>115</sup>	2018	China	MCI	2	Creative Expression Therapy	Cognitive Training	-	-	-	-	7
32	Zhu <sup>116</sup>	2018	China	MCI	2	Dance	Control	-	-	-	-	7
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Table 2. Outcome measures by domain and subdomains

Person living with dementia measures		N
Domain and subdomain	Outcome Measure	
<b>Cognition/Memory</b>		<b>219</b>
Cognition	MMSE	37
	Trail Making Test	27
	Digit Span Test	12
	ADAS-Cog	10
	Rey Auditory Test	9
	Rivermead Behavioural Memory Test	9
	Stroop Test	7
	MMQ	7
	Novelli Lexical Test	7
	MoCA	6
	CDR	6
	Verbal Fluency	6
	CERAD-NB	5
	Addenbrooke's Cognitive Examination	4
	Boston Naming Test	4
	Rey Osterrieth Complex Figure Task	4
	Montreal Cognitive Test	3
	Attentional Matrices Test	3
	California Verbal Learning Test	3
	Digit Symbol Coding Test	3
	Hopkins Verbal Learning Test	3
	The Wechsler Memory Scale	3
	CAMcog	2
	Cognitive Failures Test	2
	Color Trails Test	2
	Dementia Rating Scale-2	2
	DSM IV Test	2
	Auditory Verbal Learning Test	2
	Corsi's Block Tapping Test	2
	Frontal Assessment Test	2
	Fuld Object Memory Evaluation	2
	Logical Memory (Subtest of Wechsler Memory Scale)	2
	Prospective and Retrospective Memory Questionnaire	2
	Pyramids & Palm Trees	2
	Questionnaire d'Auto Evaluation de la Memoire	2
	Raven's Coloured Matrices	2
	Repeatable Battery Test	2
	The verbal learning and memory test	2
	Visual Memory Span	2
	Wechsler Adult Intelligence Scale	2
Knowledge of Memory Strategies	Memory Strategy Toolbox	2
	Strategy Knowledge Repertoire	1
Attention	Test of Everyday Attention	2
<b>Behavioural and Psychological Symptoms of dementia</b>		<b>51</b>
Anxiety/Depression	Geriatric Depression Scale*	21
	Cornell Scale for Depression in Dementia*	7



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	Hospital Anxiety and Depression Scale	4
	Beck Depression Inventory	1
Other	Neuropsychiatric Inventory*	12
	Apathy Evaluation Scale	3
	Revised Memory and behaviour problem checklist*	
<b>Everyday Living</b>		<b>20</b>
Activities of daily Living	Instrumental Activities of Daily Living*	8
	Bayer Activities of Daily Living Scale	3
	Alzheimer's Disease Cooperative Study Activities of Daily Living Scale	2
	Barthel index	2
Functional Ability	Functional Activities Questionnaire	3
	Functional and Cognitive Assessment Test and Functional Rating Scale for Dementia	2
<b>Physical Outcomes</b>		<b>19</b>
Physical Performance	Timed Up and Go Test	7
	Gait	3
	Handgrip strength	3
	Stride	2
	Walking Speed	2
Physical Measures	Weight	2
<b>Quality of Life/Wellbeing</b>		<b>15</b>
Quality of Life	QoL in Alzheimer's Disease*	7
	Dementia Quality of Life Instrument*	3
	EuroQoL EQ 5D*	2
	EQ-VAS	1
Stress	Perceived Stress Scale	1
General Wellbeing	SF-36	1
<b>Biological Outcome</b>		<b>9</b>
Brain Activity	EEG	4
	MRI	2
Biomarker	BDNF	3
<b>Adherence to Intervention</b>		<b>2</b>
Adherence to intervention	Adherence	2
<b>Caregiver Measures</b>		
<b>Domain</b>	<b>Outcome Measure</b>	<b>N</b>
<b>Depression</b>		<b>5</b>
	The Center for Epidemiological Studies Depression Scale*	3
	Geriatric Depression Scale	1
	Beck Depression Inventory	1
<b>Caregiver Burden</b>		<b>2</b>
	Zarit caregiver burden interview*	2
<b>General Wellbeing</b>		<b>1</b>
	Short Form Health Survey (SF-36)*	1
<b>Knowledge of Memory Strategies</b>		<b>1</b>
	Strategy Knowledge Repertoire	1
<b>Quality of Life</b>		<b>1</b>
	EQ-VAS	1

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**Stress**

Perceived Stress Scale

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\*Measure recommended by INTERDEM Consensus [14]

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**Table 3. Outcome measures by diagnosis and intervention**

	Number of Studies	BPSD	Biological Outcome	Caregiver Measure	Cognition/Memory	Everyday Living	Physical Measures	Physical Performance	Quality of Life/Wellbeing	Task Performance
<b>Diagnosis</b>										
Both	6	5	-	1	12	1	-	-	-	-
Dementia	14	16	-	7	42	6	-	-	6	-
MCI	72	30	9	3	165	13	2	17	9	2
<b>Type of Intervention</b>										
Animal Assisted Therapy	2	2	-	-	2	1	-	-	-	-
Art-Based Therapy	2	1	-	1	6	1	-	-	-	-
Case Management	2	2	-	3	1	-	-	-	1	-
Chinese Calligraphy	2	1	1	-	4	-	-	-	-	-
Cognitive Training	37	23	2	3	103	11	-	1	6	2
Cognitive Training and Physical Activity	4	-	-	-	14	2	-	2	-	-
Multicomponent	4	6	-	3	10	2	-	2	3	-
Psychosocial Intervention	2	1	-	-	7	-	1	2	1	-
Music Based Intervention	2	1	-	-	7	-	1	2	1	-
Physical Activity	25	11	6	-	53	3	1	10	2	-
Reminiscence Therapy	2	1	-	-	2	-	-	-	-	-
Support Group	3	3	-	1	1	-	-	-	1	-

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Figure 1. Flow Chart of Included Studies

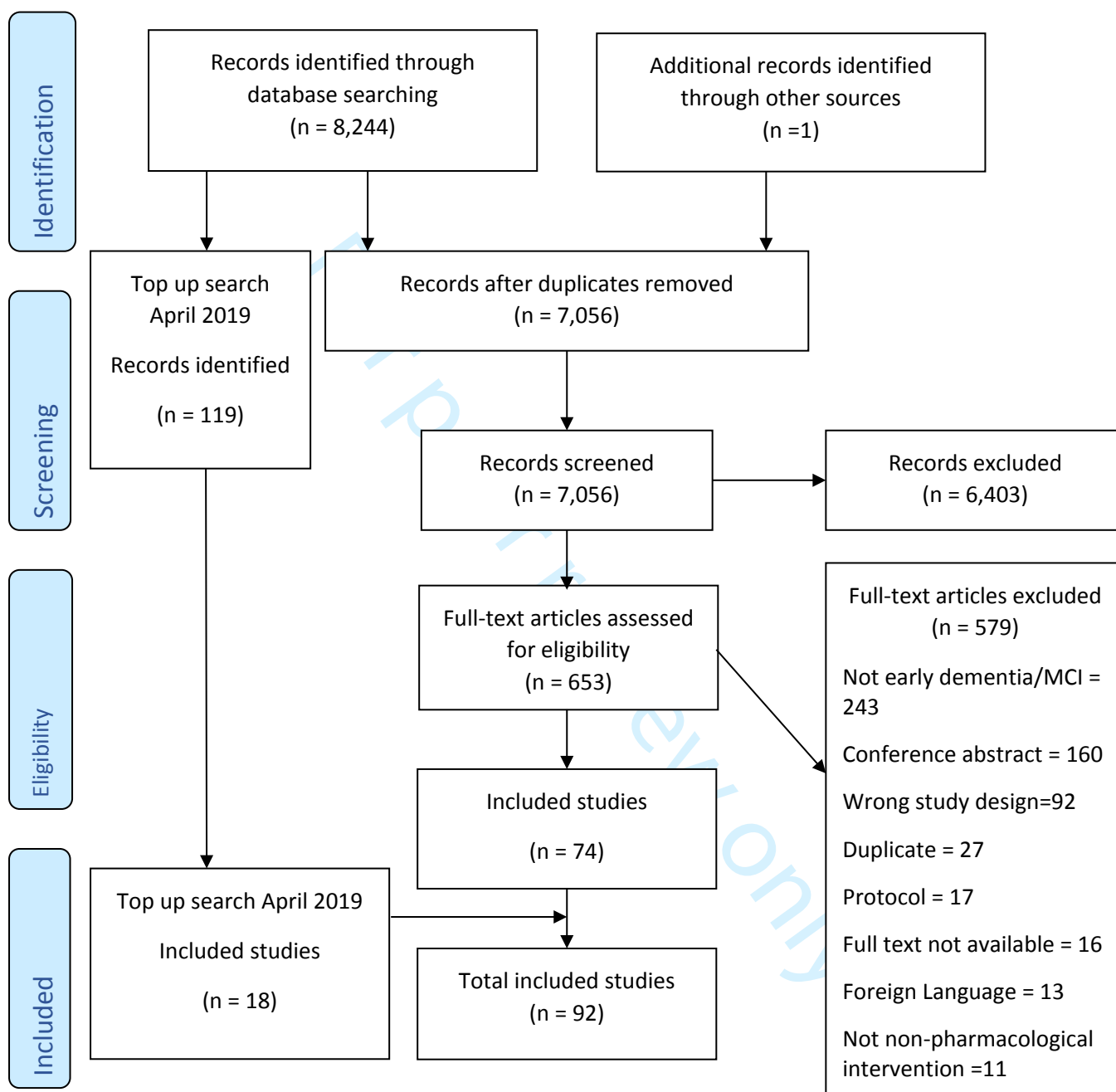
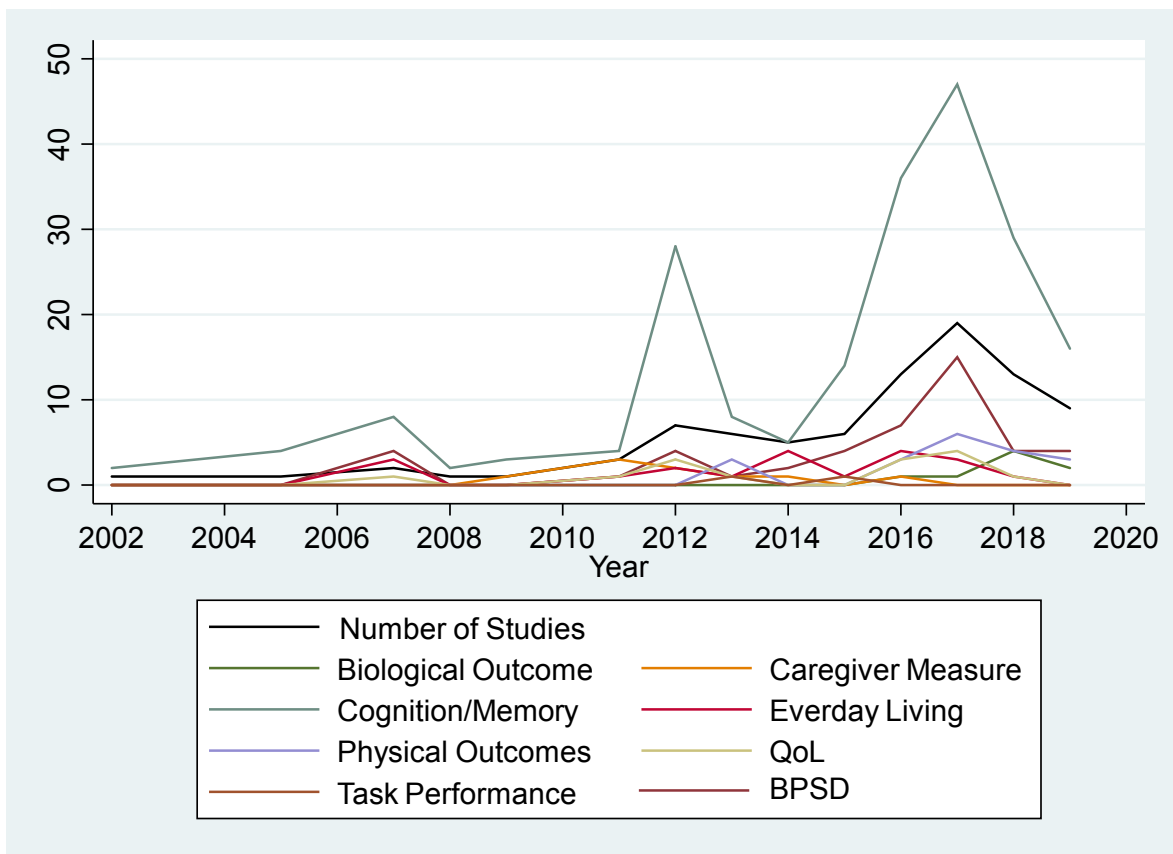


Figure 2. outcome measures over time



Note: QoL = quality of life; BPSD = behavioural and psychological symptoms of dementia.

## Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>TITLE</b>			
Title	1	Identify the report as a scoping review.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	2
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	5
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	5-6
<b>METHODS</b>			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	6
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	6-7
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	7
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Table 1
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	8
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	8
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	8
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	8



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>RESULTS</b>			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	9 and Figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	9 and Table 2
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Not feasible
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	10-12
<b>DISCUSSION</b>			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	12
Limitations	20	Discuss the limitations of the scoping review process.	14
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	15
<b>FUNDING</b>			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	15

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

\* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* ;169:467–473. doi: 10.7326/M18-0850



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## Outcomes tested in non-pharmacological interventions in mild cognitive impairment and mild dementia: a scoping review

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Secondary Subject Heading:	Geriatric medicine
Keywords:	Dementia < NEUROLOGY, Old age psychiatry < PSYCHIATRY, STATISTICS & RESEARCH METHODS

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3 1 **Outcomes tested in non-pharmacological interventions in mild cognitive impairment and**  
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6 2 **mild dementia: a scoping review**  
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12 4 Elyse Couch<sup>1\*</sup>, Vanessa Lawrence<sup>1</sup>, Melissa Co<sup>1</sup>, and A. Matthew Prina<sup>1</sup>  
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3 **1 Abstract**  
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6 2 Objectives: Non-pharmacological treatments are an important aspect of dementia care. A wide  
7  
8 3 range of interventions have been trialled for mild dementia and mild cognitive impairment (MCI).  
9  
10 4 However, the variety of outcome measures used in these trials makes it difficult to make meaningful  
11  
12 5 comparisons. The objective of this study is to map trends which outcome measures are used in trials  
13  
14 6 of non-pharmacological treatments in MCI and mild dementia.  
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18 7 Design: Scoping Review  
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21 8 Data Sources: EMBASE, Psych Info, Medline and the Cochrane Register of Controlled Trials were  
22  
23 9 searched from inception until February 2018. An additional search was conducted in April 2019  
24

25  
26 10 Eligibility: We included RCTs testing non-pharmacological interventions for people diagnosed with  
27  
28 11 MCI or early-stage dementia. Studies were restricted to full RCTs; observational, feasibility and pilot  
29  
30 12 studies were not included.  
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32  
33 13 Charting Methods: All outcome measures used by included studies were extracted and grouped  
34  
35 14 thematically. Trends in the types of outcome measures used were explored by type of intervention  
36  
37 15 country and year of publication.  
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41 16 Results: 91 studies were included in this review. We extracted 358 individual outcome measures, of  
42  
43 17 which 78 (22%) were used more than once. Cognitive measures were the most frequently used, with  
44  
45 18 the MMSE being the most popular.  
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47  
48 19 Conclusions: Our findings highlight an inconsistency in the use of outcome measures. Cognition has  
49  
50 20 been prioritised over other domains, despite previous research highlighting the importance of  
51  
52 21 quality of life and caregiver measures. To ensure a robust evidence base, more research is needed to  
53  
54 22 highlight which outcome measures should be used over others.  
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58 23 Protocol Registration: The protocol for this study was registered on PROSPERO (ID:  
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60 24 CRD42018102649).

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3 1 **Word count: 4,255**  
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9 3 **Strengths and Limitations of this study:**  
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12 4 • This scoping review has systematically mapped which outcome measures have been used by  
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14 5 randomised controlled trials testing non-pharmacological treatments in mild dementia and  
15  
16 6 mild cognitive impairment.  
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19 7 • This review has explored how the use of outcome measures varies by diagnosis, type of  
20  
21 8 intervention, country and year of publication.  
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23 9 • The papers included in this review were limited to full randomised controlled trials, other  
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25 10 study designs may be using different types of outcome measures.  
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28 11 • Further research is needed to establish which measures should be used over others.  
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## 1 Introduction

2 Delivery of both pharmacological and non-pharmacological treatment in the early stages of  
3 dementia has been identified as a global priority<sup>1,2</sup>. Current pharmacological treatments for the  
4 cognitive symptoms of dementia have been found to have a greater effect when delivered as early  
5 as possible<sup>3</sup> however, the benefits of delivering non-pharmacological treatments early are less well  
6 understood. Non-pharmacological treatments are an important clinical tool for managing dementia  
7 as they are more acceptable to some and less prone to side effects, making them a safe alternative  
8 to drug treatments<sup>4</sup>. Those diagnosed earlier in the disease have more cognitive abilities available to  
9 engage with non-pharmacological treatments and bolster their own methods for coping with the  
10 disease<sup>5</sup>. Previous systematic reviews have found non-pharmacological treatments can improve  
11 outcomes; however, these reviews were restricted to a small number of outcome measures<sup>6,7</sup>.

12 Mild cognitive impairment (MCI) has been identified as a potential prodrome for dementia, with  
13 approximately 10% of people with MCI converting to a diagnosis of dementia<sup>8</sup>. There is an interest  
14 in MCI, as a diagnosis of MCI can facilitate an early diagnosis of dementia and therefore earlier  
15 access to dementia services and treatment<sup>9</sup>. MCI is a potentially reversible condition, with many  
16 people with MCI reverting back to normal levels of cognition<sup>9</sup> therefore, it is important treatments  
17 are available. However, it is not clear which treatments can reverse MCI or prevent conversion to  
18 dementia<sup>3</sup>. No drug treatments for MCI have been found to be effective<sup>10,11</sup> and  
19 acetylcholinesterase inhibitors are not recommended, however, there is some limited evidence that  
20 non-pharmacological interventions may be beneficial<sup>3,12</sup>.

21 Randomised Controlled Trials (RCTs) testing non-pharmacological treatments in dementia and MCI  
22 are becoming more common. However, they are highly heterogeneous in terms of participants  
23 recruited, quality of the study and the types of interventions they are testing, making it difficult to  
24 establish the effectiveness of one treatment over another<sup>6,12,13</sup>. Compounding these issues is the  
25 inconsistent use of outcome measures in this area of work<sup>9,14</sup>.

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2  
3 1 Systematic reviews have identified possible benefits of non-pharmacological treatment, yet meta-  
4  
5 2 analyses are difficult to conduct due to the variation in outcome measures used by studies and  
6  
7 3 typically yield small to moderate effect sizes<sup>6 7</sup>. It is possible that these small effect sizes are due to  
8  
9 4 the selection of outcome measures which either lack sensitivity or the change following the  
10  
11 5 intervention not being in the area covered by the outcome measure. It is important researchers are  
12  
13 6 clear on which domains their interventions are targeting, and which measures are best able to  
14  
15 7 capture this change<sup>15</sup>. Pharmacological treatments target specific biological pathways underlying  
16  
17 8 the disease; therefore, outcome measures have been chosen to reflect this and typically focus on  
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19 9 cognitive and functional decline<sup>16</sup>. Non-pharmacological treatments generally do not target the  
20  
21 10 underlying biological pathway of the disease therefore, outcome measures should theoretically  
22  
23 11 differ between pharmacological and non-pharmacological treatments<sup>17</sup>. However, a review on non-  
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25 12 pharmacological approaches to treating found that studies tended to pay little attention to the  
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27 13 mechanisms of change underlying the intervention<sup>4</sup>. The expected mechanisms of change should  
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29 14 affect which outcomes are used in non-pharmacological treatments for mild dementia and MCI.  
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35 15 In addition to being clear on how change arises in non-pharmacological treatments, there needs to  
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37 16 be a more coherent use of outcomes and the measures used to capture these between studies to  
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39 17 ensure a broad and robust evidence base<sup>15</sup>. In 2008, the INTERDEM group, a consortium of  
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41 18 dementia researchers across Europe, did work to draw a consensus on which outcome measures  
42  
43 19 should be used when evaluating non-pharmacological treatments. They recommended 22 measures  
44  
45 20 across nine domains including quality of life, mood, global functioning, behaviour, daily living skills,  
46  
47 21 caregiver mood, caregiver burden and staff morale<sup>15</sup>. This guidance does not explore outcomes by  
48  
49 22 the stage of the disease. The outcome measures were selected based on their applicability to  
50  
51 23 European research. The utility of outcome measures may vary by culture<sup>16</sup>, previous reviews  
52  
53 24 exploring the use of outcome measures in dementia research have not investigated how this differs  
54  
55 25 by country<sup>17</sup>.  
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3 1 It is not understood which outcome measures are currently being used in non-pharmacological  
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5 2 treatments for early dementia and MCI. Scoping reviews present the opportunity to map the  
6  
7 3 evidence on a topic <sup>18</sup>, unlike a systematic review scoping reviews can be used to summarise the  
8  
9 4 evidence in a heterogeneous body of literature. Therefore, the aim of this scoping review is to map  
10  
11 5 trends in which outcome measures are being used in RCTs for non-pharmacological treatments in  
12  
13 6 MCI and mild dementia.

### 17 *Objectives*

19  
20 8 The specific objectives of this scoping review are to:

- 21  
22  
23 9 (1) Chart which outcomes measures have been used to assess the effectiveness of  
24  
25 10 nonpharmacological treatments in mild dementia and MCI  
26  
27 11 (2) Highlight which types of measures have been used most frequently  
28  
29 12 (3) Explore whether the outcome measures used differ depending on the type of intervention,  
30  
31 13 study population, and country the research was conducted in.

### 35 **Methods**

#### 37 *Protocol registration*

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39  
40 16 The protocol for this review was developed following the guidelines set out by the Preferred  
41  
42 17 Reporting Items for Systematic Reviews and Meta-Analysis Extension (PRISMA) statement <sup>19</sup> and the  
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44 18 PRISMA guidelines for Scoping Reviews (PRISMA-ScR) <sup>18</sup>. The protocol was registered prospectively  
45  
46 19 on PROSPERO (ID: CRD42018102649).

#### 50 *Eligibility criteria*

51  
52  
53 21 We included RCTs testing non-pharmacological interventions for people diagnosed with MCI or mild  
54  
55 22 dementia. Studies were restricted to full RCTs; observational, feasibility and pilot studies were not  
56  
57 23 included.



1 Studies were included if they met the following criteria:

- 2 • Testing non-pharmacological interventions. Studies were not excluded if participants were  
3 also treated with acetylcholinesterase inhibitors.
- 4 • Participants had a diagnosis of MCI or mild dementia, which was either diagnosed in clinical  
5 practice, or met standardised diagnostic criteria, such as the International Statistical  
6 Classification of Diseases (ICD-10) or The Diagnostic Statistical Manual of Mental Disorders  
7 (DSM), The National Institute of Communicative disorders and Stroke and the Alzheimer's  
8 Disease and Related Disorders (NINCDS-ADRDA), the International working group on MCI  
9 criteria, The Consortium to Establish a Registry for Alzheimer's Disease (CERAD), The  
10 National Institute on Aging- Alzheimer's Associating Diagnostic Guidelines for Alzheimer's  
11 Disease, the Petersen Criteria; or was defined by a standardised clinical measure, such as  
12 scores between 24-18 on the Mini-Mental State Exam (MMSE); scores  $\leq 26$  on the Montreal  
13 Cognitive Assessment (MoCA), scores between 15-27 on the St Louis University Mental  
14 Status (SLUMS), a Clinical Dementia Rating (CDR) score of 1 (for dementia) or 0.5 (for MCI);  
15 or a 4 (for dementia) or 3 (for MCI) on the Global Deterioration Scale (GDS). Studies which  
16 include a mix of participants with early dementia and MCI were included, however, studies  
17 which included healthy participants and participants with dementia at the later stages of the  
18 disease were excluded.
- 19 • The intervention was targeted for the person living with dementia or MCI. Dyadic  
20 interventions, interventions delivered to both the person living with dementia and their  
21 caregivers, were included. Interventions delivered solely to caregivers or health care  
22 professionals were excluded.
- 23 • Participants were living in long term care facilities or the community
- 24 • Written in English

25 Studies were excluded if:

- 1 • Only pharmacological interventions were tested
- 2 • The participants were diagnosed with vascular cognitive impairment or young-onset
- 3 dementia or Parkinson's Disease Dementia
- 4 • Participants were living in a psychiatric inpatient or acute hospital setting
- 5 • The intervention had the primary aim of treating major depressive disorder
- 6 • The study tested palliative care interventions or advanced care planning
- 7 • The only outcome measures used were economic outcomes, such as cost-effectiveness etc.

#### 8 *Information sources and search strategy*

9 To identify potentially relevant studies, we searched EMBASE, Psych Info, Medline and the Cochrane  
10 Register of Controlled Trials from inception until 22<sup>nd</sup> February 2018. An additional search was  
11 conducted on 2<sup>nd</sup> April 2019. See **Supplementary Table 1** for the final search strategy for MEDLINE,  
12 which was adapted for the other databases. The final search results were exported into EndNote  
13 where duplicates were removed.

14 Additional papers were identified by searching the references of included papers and other  
15 systematic reviews. Conference abstracts and publications were not included.

#### 16 *Selection of sources of evidence*

17 Study selection was managed in Rayyan, where citations were screened against the inclusion and  
18 exclusion criteria. Rayyan is an online app for systematic reviews which allows researchers to create  
19 their own coding system for decision making<sup>20</sup>. References were first screened by title and abstract,  
20 followed by a full-text screening. A second reviewer (MC) screened 10% of the articles at each stage  
21 of the review. Disagreements were resolved by discussions with a third reviewer (MP).

22 A critical appraisal or assessment of the risk of bias is not necessary for a scoping review<sup>18</sup>. This  
23 scoping review is not aiming to critically appraise the cumulative literature of outcome measures for

1 non-pharmacological treatment in MCI and mild dementia, therefore we did not conduct a critical  
2 appraisal or risk of bias assessment for this review.

### 3 *Data charting process and data items*

4 Data from eligible studies were charted using a standardised extraction tool designed for this study.  
5 Items deemed most relevant to the review objectives were the diagnosis of the study participants,  
6 description of interventions being tested, the number of intervention groups, and outcome  
7 measures used with references.

### 8 *Synthesis of results*

9 The charted data were mapped to reflect the objectives of this review. Following data charting,  
10 outcome measures which were used more than once across the included studies were grouped by  
11 domain. We grouped the interventions thematically by the type of intervention being tested.  
12 We explored which types of outcome measures were used by intervention type, by tabulating the  
13 type of intervention against the domain of the outcome measure. We excluded interventions which  
14 were only used once from this summary. Results were presented in tables and summarised  
15 narratively.

### 16 *Patient and Participant Involvement*

17 The South London and Maudsley MALADY group, of current and former carers of people living with  
18 dementia, were consulted in the planning of this study.

## 19 **Results**

### 20 *Included studies*

21 After duplicates were removed, a total of 7,056 citations were screened for inclusion, 653 were  
22 screened at full text and 76 papers were initially identified. A top-up search in April 2019 identified  
23 119 new citations, 17 were included making the total number of included studies 91, See **Figure 1**.

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2  
3 1 The studies included in this review are described in **Table 1**, including diagnosis of included  
4  
5 2 participants, number of intervention groups, details on the interventions and comparisons tested  
6  
7 3 and the number of outcomes measures used. The included studies were published between 2002  
8  
9 4 and 2019.

10  
11  
12 5 The majority of studies included in this review were conducted in the USA (n=10), Hong Kong (n=10),  
13  
14 6 and Italy (n=10). Followed by mainland China (n=7), Japan (n=7), and South Korea (n=7). Studies  
15  
16 7 were also conducted in: Argentina, Australia, Brazil, Canada, Czech Republic, Denmark, France,  
17  
18 8 Finland, Germany, Greece, Hungary, Iran, Norway, Pakistan, Singapore, Spain, Taiwan, The  
19  
20 9 Netherlands, Turkey, and the United Kingdom; these countries had fewer than 5 included studies  
21  
22 10 each.

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26  
27 11 Most studies only recruited participants with MCI (n=72), followed by mild dementia only (n=15),  
28  
29 12 and six studies recruited both participants with MCI and mild dementia.

### 30 31 32 13 *Results of individual sources of evidence*

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35 14 We extracted 358 individual outcome measures from the included studies, of these 78 (22%) were  
36  
37 15 used more than once. Out of the 78 measures used more than once, 70 (88%) were measures of  
38  
39 16 participants living with dementia (PLWD), 6 measures were used in both the PLWD and their  
40  
41 17 caregiver, 2 measures were only of the caregiver. The number of outcome measures used by each  
42  
43 18 study ranged between one and 21 with an average of 6.85.

### 44 45 46 47 19 *Types of non-pharmacological interventions*

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49  
50 20 We grouped the interventions thematically by type. The most frequently tested type of intervention  
51  
52 21 was cognitive training (n=36) followed by physical activity (n=25), combined physical activity and  
53  
54 22 cognitive training (n=4), multicomponent psychosocial interventions (n=4) and support groups (n=3).  
55  
56 23 Animal-assisted therapies, art-based therapies, case management, Chinese calligraphy, music-based  
57  
58 24 interventions and reminiscence therapy were each tested in two studies.

1 A group weight loss programme, mindfulness, social activities, transcranial direct current  
2 stimulation (TDS), transcutaneous electrical nerve stimulation (TENS), and Transcranial magnetic  
3 stimulation (TMS) were each trialled once. These interventions were not included in the analysis of  
4 trends in outcome measures.

#### 5 *PLWD outcome measures*

6 **Table 2** presents the PLWD specific outcome measures grouped by domain. The most frequently  
7 measured domain in PLWD was cognition/memory, which was measured 219 times across the 93  
8 included studies. The most frequent measure of cognition was the MMSE, which was measured 37  
9 times. In addition to measures of memory performance knowledge of memory strategies was  
10 measured 3 times in PLWD.

11 The next most frequently measured domain in PLWD was behavioural and psychological symptoms  
12 of dementia (BPSD), within this depression was the most commonly measured BPSD. The Geriatric  
13 Depression Scale was the most used measure in this domain, followed by the Neuropsychiatric  
14 Inventory which examines a greater number of symptoms. Other BSPDs measured were apathy and  
15 agitation resulting from memory problems.

16 Quality of life and wellbeing were measured 15 times across the included study. Quality of life was  
17 measured 15 times using four different instruments, the most popular of which was Logsdon's  
18 Quality of Life in Alzheimer's disease scale which was used seven times.

19 Measures of everyday living, physical ability, biological outcomes and adherence to the intervention  
20 delivered in the study were measured less than 20 times across the included studies.

#### 21 *Caregiver measures*

22 Eight interventions in this study were dyadic <sup>21-28</sup>, all included outcome measures specific to the  
23 caregiver in addition to the PLWD. One study of an intervention solely delivered to the PLWD also  
24 included a caregiver specific measure <sup>29</sup>.

1 **Table 2** also presents the outcome measures administered to caregivers grouped by domain. The  
2 Center for Epidemiological Studies Depression Scale and the Zarit Caregiver Burden interview were  
3 the only measures which were administered solely to caregivers. The other caregiver measures were  
4 also administered to PLWD. The most frequently measured domain in caregivers was depression,  
5 followed by caregiver burden. General wellbeing, knowledge of memory strategies, quality of life  
6 and stress were each measured once.

#### 7 *Use of outcome measures over time*

8 Randomised controlled trials of non-pharmacological treatments in mild dementia and MCI have  
9 become more frequent over recent years. Almost half (48%) of studies included in this review were  
10 published between 2016 and 2018.

11 **Figure 2** charts trends in outcome measure domains over time. As the number of studies in this area  
12 has increased over time, so too has the use of outcome measures in all domains. Cognition/memory  
13 has consistently been measured over other domains from the beginning of this sample. The only  
14 noticeable trend change is in measures of BPSD, which was generally in line with other domains until  
15 around 2012, when it overtakes other domains.

16 Nearly all studies in 2014 included a measure of everyday living; however, since then, the number of  
17 studies including these measures has declined. Where measures of everyday living are being used  
18 less, measures of BPSD are being used more.

19 Similarly, caregiver measures were consistently used until 2011, when in 2010 and 2011 all studies  
20 included a caregiver measure, however since then the use of such measures has declined.

#### 21 *Use of outcome measures by intervention*

22 **Table 3** presents diagnosis and type of intervention by the domains measured. Cognition/memory  
23 was the most measured domain across all diagnostic groups, followed by BPSD. The third most

1 common domain for MCI studies was physical performance, whereas caregiver measures were the  
2 third most common type of measures used in studies of early dementia,  
3 Cognition/memory was measured in all types of intervention. Measures of BPSD were most common  
4 in cognitive training interventions and physical activity interventions, however, they were not used  
5 by combined cognitive and physical training interventions. Quality of life was measured by studies  
6 of case management, cognitive training, psychosocial interventions, physical activity and support  
7 groups.

8 Caregiver measures were used in five types of interventions. Case management, cognitive training  
9 and psychosocial interventions; followed by arts-based therapy and support groups.

#### 10 *Use of outcome measures by country*

11 **Table 4** presents the country the research was conducted in by outcome measure domain.

12 Generally, there was not too much variability in the domain of outcome measures used by country.

13 Cognition/memory was the domain most frequently measured by all countries, followed by BPSD.

14 The majority of studies were conducted in China (including Hong Kong and Taiwan), these studies  
15 focused on cognition/memory, BPSD and biological outcome measures. Other than China, only three  
16 other countries included biological measures (Iran, Pakistan and the USA). The USA had the second  
17 largest number of studies included in this review, these studies favoured cognition/memory, BPSD,  
18 caregiver measures and quality of life. Out of the 24 countries with studies included in this review,  
19 less than half (n=9) included measures of quality of life.

#### 20 **Discussion**

21 In this study, we used a scoping review to map which outcome measures had been used in trials for  
22 non-pharmacological treatments of mild dementia and MCI. We extracted 358 individual outcome  
23 measures used in 91 trials, only 22% of which were used more than once. We grouped the outcome  
24 measures which had been used more than once and examined differences in their use over time, by

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3 1 diagnostic group, country the research was set in and by the type of intervention they were being  
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5 2 used to evaluate. Measures of cognition and BPSDs were the most frequently used across all studies  
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7 3 and types of intervention.  
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10 4 Perhaps unsurprisingly, measures of cognition or memory are the most prevalent across all  
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12 5 countries, diagnostic groups and types of intervention with the MMSE being the most frequently  
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14 6 used outcome measure, despite the ADAS-cog having been validated as the gold-standard measure  
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16 7 of cognition<sup>15 30 31</sup>. Measuring cognition is central to measuring the progression of dementia and is a  
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18 8 clinically and empirically useful outcome to measure in dementia research<sup>31</sup>. However, in this  
19  
20 9 review, we charted 40 different measures of cognition. This indicates that while cognition has been  
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22 10 prioritised as an outcome in studies of non-pharmacological interventions, there is no consensus  
23  
24 11 between researchers on which specific measures should be used. In addition to measures of  
25  
26 12 cognitive performance, three studies have also measured participants knowledge or retention of  
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28 13 memory strategies, indicating an interest in longer-term coping strategies for memory loss.  
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31 14 Measures of the BPSD have become more common over time, becoming in 2017 the most measured  
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33 15 outcome after cognition. There is not much variety in the BPSDs which have been measured.  
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35 16 Generally, depression was measured over other BPSDs. Other BPSDs such as agitation were  
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37 17 measured less, perhaps because they are more associated with the later stages of the disease and  
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39 18 depression is associated with the earlier stages<sup>32</sup>.  
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42 19 Quality of life and wellbeing were not amongst the most measured domains. Four measures of  
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44 20 quality of life were used 13 times across the included studies and all but one of these measures were  
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46 21 dementia specific measures. It is surprising quality of life has not been measured more, as previous  
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48 22 research has stated that in the absence of a cure, health care providers have a greater ability to  
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50 23 improve quality of life than alter the progression of the disease<sup>33</sup>. Furthermore, both people with  
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52 24 MCI and caregivers rated quality of life of the patient as the most important outcome to measure,  
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54 25 followed by caregiver quality of life/burden<sup>34</sup>. Indicating while quality of life has been identified as a  
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3 1 priority by PLWD, people diagnosed with MCI and their caregivers in previous research, the findings  
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5 2 of this study shows this is not being translated into trials of non-pharmacological treatments for  
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7 3 early dementia and MCI.  
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10 4 Likewise, caregiver measures had consistent low use across the studies included in this review. We  
11  
12 5 charted eight caregiver measures which were used 11 times across the included studies. Caregiver  
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14 6 measures were more commonly used in studies of PLWD, rather than MCI. Previous research has  
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16 7 highlighted the profound effect dementia on their caregivers, with around half of caregivers  
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18 8 experiencing high levels of burden<sup>35</sup>. However, a third of caregivers of people with MCI also report  
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20 9 extreme levels of burden<sup>36</sup>, yet the findings of this study show this is less investigated.  
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24 10 There was great variability in the types of outcomes being used to evaluate the different types of  
25  
26 11 intervention. All studies measured cognition and all but one measured BPSD. A lack of clarity in how  
27  
28 12 change occurs as a result of non-pharmacological treatments is a fundamental weakness in this area  
29  
30 13 of work<sup>4</sup>. It is unlikely that all interventions being tested in this review could hope to improve  
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32 14 cognition, however this is the most prevalent domain of outcome measures. There are a number of  
33  
34 15 practical reasons as to why certain outcomes, and therefore outcome measures are used over  
35  
36 16 others, In the past, pharmacological treatments have been required to include some measure of  
37  
38 17 cognition, functional or global assessment<sup>17</sup>, it is possible that this approach has influenced the  
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40 18 choice in outcomes used in non-pharmacological studies. Furthermore, some measures may be used  
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42 19 over others for more practical reasons. For example, measures which are short to administer and  
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44 20 free to use may be priorities over others<sup>31</sup>. Several interventions in this review comprise of more  
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46 21 than one component, e.g. physical activity and cognitive training. In these cases, it may take multiple  
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48 22 measures over many domains to accurately capture change. It is vital that outcome measures are  
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50 23 be selected depending on the domains the intervention is seeking to address<sup>31</sup>.  
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56 24 In 2008, the INTERDEM group recommended 22 outcome measures for use across nine domains<sup>15</sup>.  
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58 25 We found 11 of these 22 measures (50%) were used by the studies included in this review, one of  
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3 1 the recommended domains (staff carer morale) was not applicable to the studies included in this  
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5 2 review. All measures recommended for measuring patient mood, and patient quality of life were  
6  
7 3 charted in this review. Only one of the recommended measures for the activities of daily living,  
8  
9 4 caregiver mood, caregiver burden and caregiver quality of life domains were charted and no  
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11 5 measures under the global measures domain were charted in this review. This indicates that there is  
12  
13 6 some consistency between which measures are recommended and which measures are utilised, this  
14  
15 7 is largely for patient measures and there is less consistency for caregiver measures.  
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19 8 In this study, we found that the use of outcome measures did not vary much by the country the  
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21 9 study was conducted in. In each country, cognition/memory was the most commonly tested domain,  
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23 10 followed by BPSD. The importance of outcomes may vary between cultures; therefore, it is  
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25 11 important that the outcomes and measures used reflect this<sup>16</sup>. However, due to the limitations of  
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27 12 the methodology used we cannot comment on the cultural relevance of the outcome measures  
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29 13 charted in this review. Furthermore, articles were only included if they were published in English. It  
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31 14 is possible that more culturally appropriate outcomes were used in articles published in the same  
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33 15 language as the population under investigation. This is an important area for future research.  
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### 37 38 16 *Limitations*

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41 17 The findings of this review must be interpreted in the context of the study. To make this review  
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43 18 feasible we only included full RCTs, other outcome measures may have been used in different types  
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45 19 of studies. Due to time constraints, some sub-types of dementia and cognitive impairment (young-  
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47 20 onset, Parkinson's disease dementia and vascular cognitive impairment) were excluded from this  
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49 21 review, which limits the applicability of these findings. Further research is needed to explore  
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51 22 whether the pattern in the use of outcomes and outcome measures is similar in these groups,  
52  
53 23 compared with the ones included in this review. Furthermore, only outcome measures which were  
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55 24 published could be included in this review. The studies included in this study were heterogeneous in  
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57 25 terms of participants recruited, interventions tested, and outcome measures used, making it difficult  
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1 to group them thematically. It is possible some nuance is lost in the exploration of broader themes.  
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1 to group them thematically. It is possible some nuance is lost in the exploration of broader themes.  
2 As with the nature of scoping reviews, we are only able to present which outcome measures have  
3 been used in previous research, we are unable to draw conclusions as to which outcome measures  
4 should be used over others. Future research should explore which populations measures have been  
5 validated for and what constitutes a clinically useful change.

### 6 *Implications and recommendations for future research*

7 The findings of this review indicate there is very little consistency in outcome measures used in RCTs  
8 for non-pharmacological interventions in MCI and mild dementia, however we are not able to  
9 conclude which measures should be used over others. To create a strong evidence base for non-  
10 pharmacological treatments more research, with the involvement of PLWD and their carers, is  
11 needed to determine which measures are preferable over a greater number of domains.  
12 Additionally, the prevalence of cognitive measures found in this study, suggests that researchers are  
13 including such measures because there is an expectation to do. Researchers should be clear on the  
14 theory behind how their intervention creates change and use the appropriate outcome measures.

### 15 **Conclusions**

16 In summary, this study has found RCTs for non-pharmacological treatments in mild dementia and  
17 MCI use a broad range of outcome measures, with a small proportion being used more than once.  
18 Excepting measures of cognition, there is very little commonality between studies. Where previous  
19 research has set priorities on outcomes preferred by PLWD, people with MCI and caregivers, quality  
20 of life for example, this has not yet translated into studies measuring new treatments. Further  
21 research is needed to understand which outcomes should be prioritised and how they should be  
22 measured.

### 23 **Contributors**

1  
2  
3 1 EC designed the study, carried out the literature review, the data charting and synthesis, data  
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5 2 interpretation, article preparation, article review and correspondence. AMP and VL contributed to  
6  
7 3 the study design, data interpretation, and article review. MC contributed to the data charting.  
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10  
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12

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16 6 **Competing interests**  
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18  
19 7 None declared  
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22 8 **Data availability statement**  
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25 9 No additional data available.  
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**Table 1. Included Studies**

Lead Author	Year	Country	Diagnosis	Number of Groups	Group 1	Group 2	Group 3	Group 4	Group 5	Number of measures
Amjad <sup>37</sup>	2019	Pakistan	MCI	2	Aerobic Exercise	Non-Aerobic Exercise	-	-	-	4
Bae <sup>38</sup>	2019	Japan	MCI	2	Multi-Intervention Programme	Active Control	-	-	-	10
Baker <sup>39</sup>	2010	USA	MCI	2	Aerobic Exercise	Stretching	-	-	-	11
Belleville <sup>40</sup>	2018	Canada	MCI	3	Cognitive Training	Psychosocial Intervention	Control	-	-	7
Biasutti <sup>41</sup>	2017	Italy	MCI	2	Cognitive Training	Gym Activities	-	-	-	4
Bono <sup>42</sup>	2015	Italy	MCI	2	Animal Assisted Therapy	Control	-	-	-	4
Burgio <sup>43</sup>	2018	Italy	MCI	2	Numerical Training	Executive Training	-	-	-	13
Buschert <sup>44</sup>	2012	Germany	MCI	2	Cognitive Training	Active Control	-	-	-	5
Carretti <sup>45</sup>	2013	Italy	MCI	2	Cognitive Training	Active Control	-	-	-	16
Cavallo <sup>46</sup>	2016	Italy	Dementia	2	Cognitive Training	Active Control	-	-	-	3
Chan <sup>47</sup>	2016	Hong Kong	MCI	2	Chinese Calligraphy	Computer Activities	-	-	-	13
Chan <sup>48</sup>	2017	Hong Kong	MCI	2	Chinese Calligraphy	Computer Activities	-	-	-	8
Choi <sup>49</sup>	2018	South Korea	MCI	2	Ground Kayaking	Home Exercise Education	-	-	-	7
Combourieu Donnezan <sup>50</sup>	2018	France	MCI	4	Physical Training	Cognitive Training	Simultaneous Cognitive and Physical Training	Control	-	4
DiNapoli <sup>51</sup>	2016	USA	MCI	2	Individualised Social Activities	Control	-	-	-	4
Doi <sup>52</sup>	2013	Japan	MCI	2	Exercise	Active Control	-	-	-	4
Doi <sup>53</sup>	2017	Japan	MCI	3	Dance	Playing Musical Instruments	Health Education Group	-	-	4
Drumond Marra <sup>54</sup>	2015	Brazil	MCI	2	TMS	Sham TMS	-	-	-	6
Emsaki <sup>55</sup>	2017	Iran	MCI	2	Cognitive Training	Active Control	-	-	-	9
Eyre <sup>56</sup>	2017	USA	MCI	2	Yoga	Cognitive Training	-	-	-	10
Feng <sup>57</sup>	2018	China	MCI	2	Single Component Cognitive Training	Multiple Component Cognitive Training	-	-	-	3
Fernandez-Calvo <sup>58</sup>	2015	Spain	Dementia	2	Multi-Intervention Programme	Control	-	-	-	21
Fiatarone Singh <sup>59</sup>	2014	Australia	MCI	4	Progressive resistance training and sham cognitive training	Progressive resistance training and cognitive training	Cognitive training	Control	-	12

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3	Finn <sup>60</sup>	2015	Australia	MCI	2	Repetition-lag Training	Control	-	-	-	6
4	Fogarty <sup>61</sup>	2016	Canada	MCI	2	Memory Intervention	Memory Intervention	-	-	-	5
5						Program and Tai Chi	Program				
6	Forster <sup>62</sup>	2011	Germany	Both	2	Cognitive Training	Control	-	-	-	10
7	Galante <sup>63</sup>	2007	Italy	Dementia	2	Cognitive Training	Active Control	-	-	-	12
8	Greenaway <sup>21</sup>	2013	USA	MCI	2	Memory Support System	Memory Support System	-	-	-	15
9						(Memory Rehabilitation)	without Training				
10						with Training					
11	Hagovska <sup>64</sup>	2017	Czech	MCI	2	Cognitive Training	Cognitive Training	-	-	-	0
12			Republic			(Computer Based)					
13	Hagovska <sup>65</sup>	2016	Czech	MCI	2	Cognitive Training and	Balance Training	-	-	-	4
14			Republic			Dynamic Balance Training					
15	Han <sup>66</sup>	2017	South Korea	MCI	2	Ubiquitous Spaced Retrieval-	Control	-	-	-	4
16						based Memory					
17						Advancement and					
18						Rehabilitation Training					
19	Han <sup>67</sup>	2017	South Korea	Both	2	Multimodal Cognitive	Active Control	-	-	-	7
20						Enhancement Therapy					
21	Hattori <sup>29</sup>	2011	Japan	Dementia	2	Art Therapy	Active Control	-	-	-	4
22	Ho <sup>68</sup>	2018	Hong Kong	Both	3	Dance Movement Therapy	Physical Exercise	Control	-	-	7
23	Horie <sup>69</sup>	2016	Brazil	MCI	2	Group Weight Loss	Control	-	-	-	10
24						Programme					
25	Hyer <sup>70</sup>	2016	USA	MCI	2	Cognitive Training	Active Control	-	-	-	3
26						(Computer Based)					
27	Jansen <sup>22</sup>	2011	The	Dementia	2	Case Management	Control	-	-	-	5
28			Netherlands								
29	Jean <sup>71</sup>	2010	Canada	MCI	2	Cognitive Training	Active Control	-	-	-	10
30	Jelcic <sup>72</sup>	2012	Italy	Dementia	2	Lexical-Semantic Treatment	Cognitive Stimulation	-	-	-	11
31	Jeong <sup>73</sup>	2016	South Korea	MCI	2	Cognitive Intervention	Cognitive Intervention	-	-	-	8
32						(Group based)	(Home Based)				
33	Kinsella <sup>23</sup>	2009	Australia	MCI	2	Cognitive Intervention	Control	-	-	-	4
34	Kohanpour <sup>74</sup>	2017	Iran	MCI	4	Aerobic Exercise	Lavender Extract	Aerobic Exercise and	Control	-	14
35								Lavender Extract			
36	Koivisto <sup>24</sup>	2016	Finland	Dementia	2	Psychosocial Intervention	Control	-	-	-	7
37	Kovacs <sup>75</sup>	2013	Hungary	MCI	2	Multimodal Exercise	Control	-	-	-	1
38	Kuster <sup>76</sup>	2016	Germany	MCI	3	Cognitive Training	Physical Training	Control	-	-	7
39	Kwok <sup>77</sup>	2012	Hong Kong	MCI	2	Cognitive Training	Active Control	-	-	-	5
40											
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2																				
3	Lam <sup>78</sup>	2012	Hong Kong	MCI	2	Tai Chi	Stretching	-	-	-	-	-	-	-	-	-	-	-	-	4
4	Lam <sup>79</sup>	2015	Hong Kong	MCI	4	Cognitive Training	Cognitive and Physical Training	Physical Training	-	-	-	-	-	-	-	-	-	-	-	2
5																				
6	Lam <sup>25</sup>	2010	Hong Kong	Dementia	2	Case Management	Control	-	-	-	-	-	-	-	-	-	-	-	-	2
7	Langoni <sup>80</sup>	2019	Brazil	MCI	2	Group Exercise	Control	-	-	-	-	-	-	-	-	-	-	-	-	14
8	Law <sup>81</sup>	2014	Hong Kong	MCI	2	Functional Tasks Exercise Programme	Cognitive Training	-	-	-	-	-	-	-	-	-	-	-	-	7
9																				
10	Lazarou <sup>82</sup>	2017	Greece	MCI	2	Ballroom Dancing	Control	-	-	-	-	-	-	-	-	-	-	-	-	5
11	Li <sup>83</sup>	2019	China	MCI	2	Computerised Cognitive Training	Control	-	-	-	-	-	-	-	-	-	-	-	-	4
12																				
13	Lim <sup>84</sup>	2018	Singapore	MCI	2	Mindfulness	Health Education	-	-	-	-	-	-	-	-	-	-	-	-	5
14	Logsdon <sup>26</sup>	2010	USA	Dementia	2	Early Stage Memory Loss Support Group	Control	-	-	-	-	-	-	-	-	-	-	-	-	10
15																				
16	Luijpen <sup>85</sup>	2005	The Netherlands	MCI	2	TENS	Sham TENS	-	-	-	-	-	-	-	-	-	-	-	-	6
17																				
18	Maffei <sup>86</sup>	2017	Italy	MCI	2	Multidomain Training	Control	-	-	-	-	-	-	-	-	-	-	-	-	10
19	Manav <sup>87</sup>	2019	Turkey	Dementia	2	Reminiscence Therapy	Social Interview	-	-	-	-	-	-	-	-	-	-	-	-	6
20																				
21	Melendez <sup>88</sup>	2015	Spain	Both	2	Reminiscence Therapy	Control	-	-	-	-	-	-	-	-	-	-	-	-	6
22	Nagamatsu <sup>89</sup>	2012	Canada	MCI	2	Aerobic Exercise	Resistance Training	-	-	-	-	-	-	-	-	-	-	-	-	13
23	Olsen <sup>90</sup>	2016	Norway	Both	2	Animal Assisted Therapy	Control	-	-	-	-	-	-	-	-	-	-	-	-	9
24	Pantoni <sup>91</sup>	2017	Italy	MCI	2	Attention Process Training	Control	-	-	-	-	-	-	-	-	-	-	-	-	4
25	Park <sup>92</sup>	2018	South Korea	MCI	2	Cognition specific computer training	Non-specific computer training	-	-	-	-	-	-	-	-	-	-	-	-	5
26																				
27	Poinsatte <sup>93</sup>	2019	USA	MCI	2	Aerobic Exercise	Stretching	-	-	-	-	-	-	-	-	-	-	-	-	3
28	Pongan <sup>94</sup>	2017	France	Dementia	2	Choral Singing	Painting	-	-	-	-	-	-	-	-	-	-	-	-	14
29	Poptsi <sup>95</sup>	2018	Greece	MCI	5	Paper Language Tasks	Computer Language Tasks	Oral Language Tasks	-	-	-	-	-	-	-	-	-	-	-	4
30																				
31	Qi <sup>96</sup>	2019	China	MCI	2	Aerobic Exercise	Control	-	-	-	-	-	-	-	-	-	-	-	-	3
32	Rapp <sup>97</sup>	2002	USA	MCI	2	Memory Enhancement Training (Multi-Component)	Control	-	-	-	-	-	-	-	-	-	-	-	-	9
33																				
34																				
35	Rojas <sup>98</sup>	2013	Argentina	MCI	2	Cognitive Intervention	Control	-	-	-	-	-	-	-	-	-	-	-	-	8
36	Rozzini <sup>99</sup>	2007	Italy	MCI	2	Cognitive Training and AChEIs	AChEIs	-	-	-	-	-	-	-	-	-	-	-	-	7
37																				
38	Savulich <sup>100</sup>	2017	UK	MCI	2	Cognitive Training	Control	-	-	-	-	-	-	-	-	-	-	-	-	9
39																				
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2												
3	Scherder <sup>101</sup>	2010	The Netherlands	MCI	3	Walking	Hand and Face Exercises	Control	-	-		11
4												
5	Shimada <sup>102</sup>	2017	Japan	MCI	2	Physical and Cognitive Training	Health Education Group	-	-	-		7
6												
7	Shimizu <sup>103</sup>	2017	Japan	MCI	2	Movement Music Therapy	Single Training Task	-	-	-		4
8	Simon <sup>104</sup>	2018	Brazil	MCI	2	Memory Training	Active Control	-	-	-		8
9	Song <sup>105</sup>	2019	China	MCI	2	Aerobic Exercise	Active Control	-	-	-		4
10	Suzuki <sup>106</sup>	2012	Japan	MCI	2	Multicomponent Exercise Group	Active Control	-	-	-		6
11												
12	Tappen <sup>27</sup>	2014	USA	Both	2	Cognitive Training (Home Based)	Life Story Interview	-	-	-		11
13												
14	Troyer <sup>107</sup>	2008	Canada	MCI	2	Multicomponent Intervention	Control	-	-	-		6
15												
16	Tsai <sup>108</sup>	2018	Taiwan	MCI	3	Aerobic Exercise	Resistance Training	Control	-	-		7
17	Tsantali <sup>109</sup>	2017	Greece	Dementia	3	Cognitive Training	Cognitive Stimulation	Control	-	-		5
18	van Uffelen <sup>110</sup>	2007	The Netherlands	MCI	4	Walking	Placebo Activity	Folic Acid/Vitamin B Supplements	Placebo Pills	-		3
19												
20	Waldorff <sup>28</sup>	2012	Denmark	Dementia	2	Multifaceted Counselling, Education and Support	Control	-	-	-		2
21												
22	Wej <sup>111</sup>	2014	China	MCI	2	Handball Training	Control	-	-	-		8
23	Yang <sup>112</sup>	2016	USA	MCI	2	Memory Enhancement Training	Yoga	-	-	-		3
24												
25	Yoon <sup>113</sup>	2017	South Korea	MCI	2	High-Speed Power Strength Training	Low-Speed Strength Training	-	-	-		5
26												
27	Young <sup>114</sup>	2014	Hong Kong	Dementia	2	Support Groups	Control	-	-	-		4
28	Young <sup>115</sup>	2017	Hong Kong	MCI	2	Holistic Health Group	Control	-	-	-		4
29	Yun <sup>116</sup>	2016	South Korea	MCI	2	TDS	Sham TDS	-	-	-		1
30	Zhao <sup>117</sup>	2018	China	MCI	2	Creative Expression Therapy	Cognitive Training	-	-	-		7
31	Zhu <sup>118</sup>	2018	China	MCI	2	Dance	Control	-	-	-		7
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**Table 2. Outcome measures by domain and subdomains**

<b>Person living with dementia measures</b>		<b>N</b>
<b>Domain and subdomain</b>	<b>Outcome Measure</b>	
<b>Cognition/Memory</b>		<b>219</b>
Cognition	MMSE	37
	Trail Making Test	27
	Digit Span Test	12
	ADAS-Cog	10
	Rey Auditory Test	9
	Rivermead Behavioural Memory Test	9
	Stroop Test	7
	MMQ	7
	Novelli Lexical Test	7
	MoCA	6
	CDR	6
	Verbal Fluency	6
	CERAD-NB	5
	Addenbrooke's Cognitive Examination	4
	Boston Naming Test	4
	Rey Osterrieth Complex Figure Task	4
	Montreal Cognitive Test	3
	Attentional Matrices Test	3
	California Verbal Learning Test	3
	Digit Symbol Coding Test	3
	Hopkins Verbal Learning Test	3
	The Wechsler Memory Scale	3
	CAMcog	2
	Cognitive Failures Test	2
	Color Trails Test	2
	Dementia Rating Scale-2	2
	DSM IV Test	2
	Auditory Verbal Learning Test	2
	Corsi's Block Tapping Test	2
	Frontal Assessment Test	2
	Fuld Object Memory Evaluation	2
	Logical Memory (Subtest of Wechsler Memory Scale)	2
	Prospective and Retrospective Memory Questionnaire	2
	Pyramids & Palm Trees	2
	Questionnaire d'Auto Evaluation de la Memoire	2
	Raven's Coloured Matrices	2
	Repeatable Battery Test	2
	The verbal learning and memory test	2
	Visual Memory Span	2
	Wechsler Adult Intelligence Scale	2
Knowledge of Memory Strategies	Memory Strategy Toolbox	2
	Strategy Knowledge Repertoire	1
Attention	Test of Everyday Attention	2
<b>Behavioural and Psychological Symptoms of dementia</b>		<b>51</b>
Anxiety/Depression	Geriatric Depression Scale*	21
	Cornell Scale for Depression in Dementia*	7



	Hospital Anxiety and Depression Scale	4
	Beck Depression Inventory	1
Other	Neuropsychiatric Inventory*	12
	Apathy Evaluation Scale	3
	Revised Memory and behaviour problem checklist*	
<b>Everyday Living</b>		<b>20</b>
Activities of daily Living	Instrumental Activities of Daily Living*	8
	Bayer Activities of Daily Living Scale	3
	Alzheimer's Disease Cooperative Study Activities of Daily Living Scale	2
	Barthel index	2
Functional Ability	Functional Activities Questionnaire	3
	Functional and Cognitive Assessment Test and Functional Rating Scale for Dementia	2
<b>Physical Outcomes</b>		<b>19</b>
Physical Performance	Timed Up and Go Test	7
	Gait	3
	Handgrip strength	3
	Stride	2
	Walking Speed	2
Physical Measures	Weight	2
<b>Quality of Life/Wellbeing</b>		<b>15</b>
Quality of Life	QoL in Alzheimer's Disease*	7
	Dementia Quality of Life Instrument*	3
	EuroQoL EQ 5D*	2
	EQ-VAS	1
Stress	Perceived Stress Scale	1
General Wellbeing	SF-36	1
<b>Biological Outcome</b>		<b>9</b>
Brain Activity	EEG	4
	MRI	2
Biomarker	BDNF	3
<b>Adherence to Intervention</b>		<b>2</b>
Adherence to intervention	Adherence	2
<b>Caregiver Measures</b>		
<b>Domain</b>	<b>Outcome Measure</b>	<b>N</b>
<b>Depression</b>		<b>5</b>
	The Center for Epidemiological Studies Depression Scale*	3
	Geriatric Depression Scale	1
	Beck Depression Inventory	1
<b>Caregiver Burden</b>		<b>2</b>
	Zarit caregiver burden interview*	2
<b>General Wellbeing</b>		<b>1</b>
	Short Form Health Survey (SF-36)*	1
<b>Knowledge of Memory Strategies</b>		<b>1</b>
	Strategy Knowledge Repertoire	1
<b>Quality of Life</b>		<b>1</b>
	EQ-VAS	1

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**Stress**

Perceived Stress Scale

\*Measure recommended by INTERDEM Consensus [14]

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**Table 3. Outcome measure domain by diagnosis and intervention**

	Number of Studies	BPSD	Biological Outcome	Caregiver Measure	Cognition/Memory	Everyday Living	Physical Measures	Physical Performance	Quality of Life/Wellbeing	Task Performance
<b>Diagnosis</b>										
Both	6	5	-	1	12	1	-	-	-	-
Dementia	14	16	-	7	42	6	-	-	6	-
MCI	71	30	9	3	163	12	2	17	9	2
<b>Type of Intervention</b>										
Animal Assisted Therapy	2	2	-	-	2	1	-	-	-	-
Art-Based Therapy	2	1	-	1	6	1	-	-	-	-
Case Management	2	2	-	3	1	-	-	-	1	-
Chinese Calligraphy	2	1	1	-	4	-	-	-	-	-
Cognitive Training	37	23	2	3	103	11	-	1	6	2
Cognitive Training and Physical Activity	4	-	-	-	14	2	-	2	-	-
Multicomponent	4	6	-	3	10	2	-	2	3	-
Psychosocial Intervention										
Music Based Intervention	2	1	-	-	7	-	1	2	1	-
Physical Activity	25	11	6	-	53	3	1	10	2	-
Reminiscence Therapy	2	1	-	-	2	-	-	-	-	-
Support Group	3	3	-	1	1	-	-	-	1	-

Table 4. Outcome measure domain by country

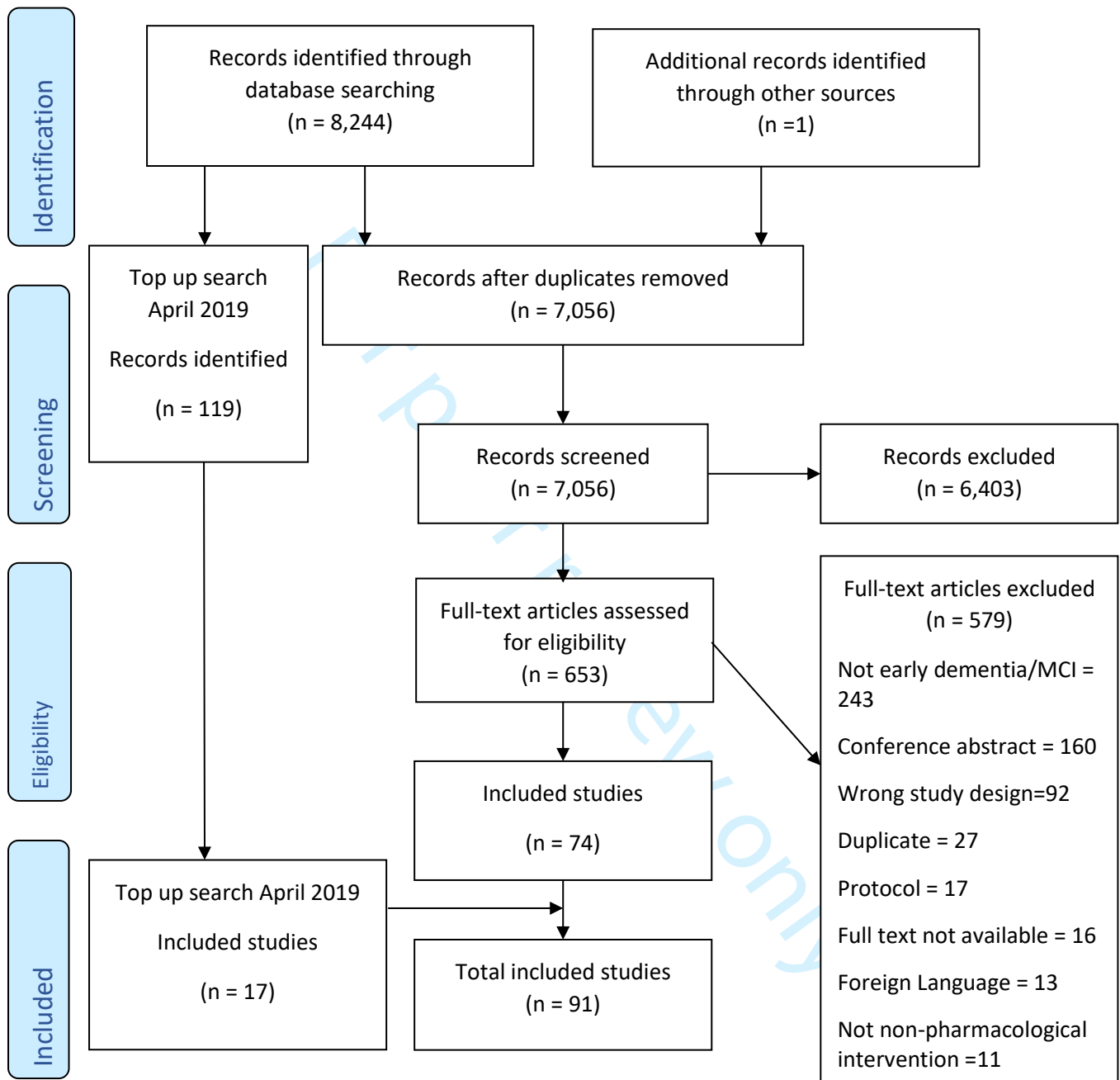
Country	Number of studies	BPSD	Biological Outcome	Caregiver Measure	Cognition/Memory	Functional ability	Physical Measures	Physical Performance	Quality of Life/Wellbeing	Task Performance
Argentina	1	1	0	0	6	1	0	0	0	0
Australia	4	0	0	1	5	1	0	0	0	0
Brazil	5	1	1	0	14	0	0	1	0	0
Canada	6	2	0	0	16	0	0	2	0	0
Mainland China, Hong Kong and Taiwan	20	10	5	1	35	2	0	0	0	1
Czech Republic	3	0	0	0	3	2	0	1	0	0
Denmark	1	2	0	2	1	1	0	0	2	0
Finland	1	1	0	1	3	1	0	0	1	0
France	3	1	0	0	6	0	0	2	1	0
Germany	4	1	0	0	10	0	0	0	1	0
Greece	4	3	0	0	18	2	0	0	1	0
Hungary	1	0	0	0	0	0	0	1	0	0
Iran	3	1	1	0	3	0	1	0	0	0
Italy	11	8	0	0	32	6	0	0	1	0
Japan	8	2	0	1	16	1	1	6	0	0
Norway	1	1	0	0	1	0	0	0	0	0
Pakistan	1	0	1	0	3	0	0	0	0	0
Singapore	1	0	0	0	0	0	0	0	0	0
South Korea	8	5	0	0	14	1	0	4	3	0
Spain	3	2	0	0	2	0	0	0	0	0
The Netherlands	5	0	0	2	10	0	0	0	2	0
Turkey	1	1	0	0	1	0	0	0	0	0
UK	1	3	0	0	1	0	0	0	0	0
USA	10	6	1	3	19	2	0	0	3	1

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5 Figure 1. Flow Chart of Included Studies  
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9 Figure 2. Trends in outcome measures over time

10 Note: QoL = quality of life; BPSD = behavioural and psychological symptoms of dementia  
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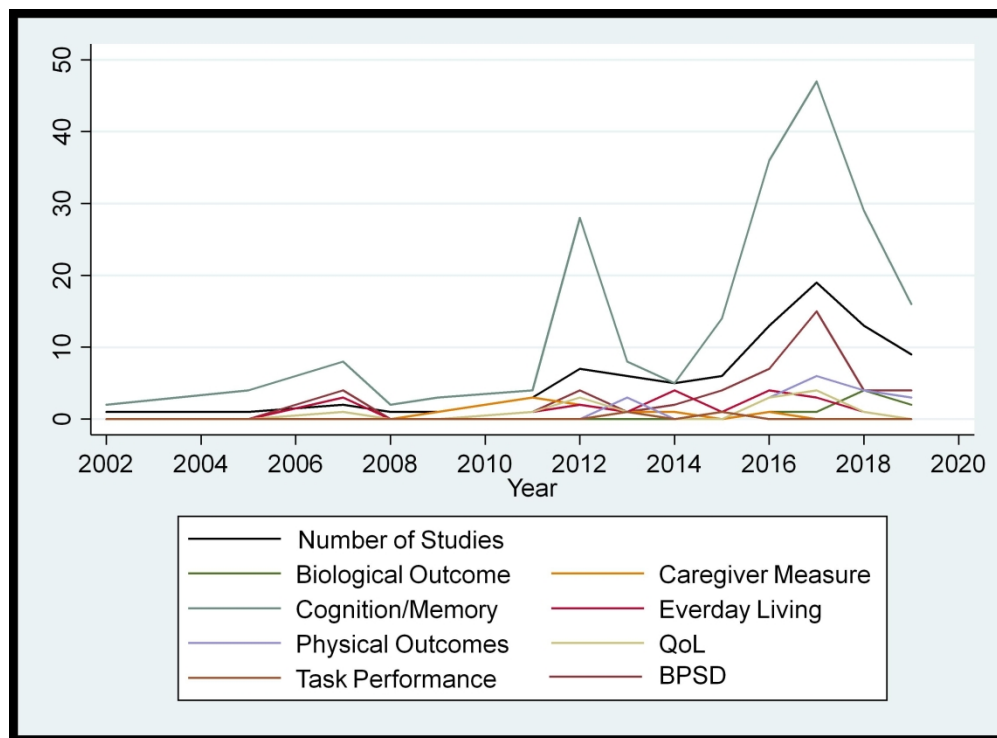


Figure 2. outcome measures over time

Note: QoL = quality of life; BPSD = behavioural and psychological symptoms of dementia.

887x651mm (96 x 96 DPI)

**Supplementary Table 1. Search Strategy for OVID**

	<b>Search term</b>		<b>Search term continued</b>
1	<b>1</b> Early dementia	<b>39</b>	self help group
2	<b>2</b> Mild dementia	<b>40</b>	psychotherapy
3	<b>3</b> mild alzheimer*	<b>41</b>	CBT
4	<b>4</b> early alzheimer*	<b>42</b>	Cognitive behavior?ral therap*
5	<b>5</b> cognitive impairment	<b>43</b>	Cognitive behavioural therap*
6	<b>6</b> age related cognitive impairment	<b>44</b>	Talking therap*
7	<b>7</b> Mild cognitive impairment	<b>45</b>	Individual therap*
8	<b>8</b> MCI	<b>46</b>	Peer support
9	<b>9</b> mild neurocognitive disorder	<b>47</b>	Counselling
10	<b>10</b> <b>1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9</b>	<b>48</b>	Communication
11	<b>11</b> cognitive training	<b>49</b>	acupuncture therap*
12	<b>12</b> brain training	<b>50</b>	acupuncture
13	<b>13</b> memory training	<b>51</b>	acupuncture points
14	<b>14</b> Behavior?r therap*	<b>52</b>	Transcranial Magnetic Stimulation
15	<b>15</b> Behavior?r modification	<b>53</b>	TMS
16	<b>16</b> pleasant activit*	<b>54</b>	Relaxation therap*
17	<b>17</b> Cognitive stimulation therapy	<b>55</b>	Therap* relaxation
18	<b>18</b> CST	<b>56</b>	Relaxation techniques
19	<b>19</b> Transcutaneous Electrical Nerve Stimulation	<b>57</b>	Early intervention
20	<b>20</b> TENS	<b>58</b>	Alternative therap*
21	<b>21</b> Exercise	<b>59</b>	<b>11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 19 OR 20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28 OR 29 OR 30 OR 31 OR 32 OR 33 OR 34 OR 35 OR 36 OR 37 OR 38 OR 39 OR 40 OR 41 OR 42 OR 43 OR 44 OR 45 OR 46 OR 47 OR 48 OR 49 OR 50 OR 51 OR 52 OR 53 OR 54 OR 55 OR 56 OR 57 OR 58 OR 59</b>
22	<b>22</b> exercise therap*	<b>60</b>	randomized controlled trial
23	<b>23</b> Walking	<b>61</b>	randomised controlled trial



<b>24</b>	music therap*	<b>62</b>	RCT
<b>15</b>	reminiscence therap*	<b>63</b>	Clinical Trial
<b>26</b>	massage therap*	<b>64</b>	intervention
<b>27</b>	therap* touch	<b>65</b>	<b>60 OR 61 OR 62 OR 63 OR 64 OR 65</b>
<b>28</b>	recreation therap*	<b>66</b>	early dementia
<b>29</b>	light therap*	<b>67</b>	mild dementia
<b>30</b>	therap* light	<b>68</b>	mild alzheimer*
<b>31</b>	sensory stimulation	<b>69</b>	early alzheimer*
<b>32</b>	multisensory stimulation	<b>70</b>	cognitive impairment
<b>33</b>	complementary therap*	<b>71</b>	age related cognitive impairment
<b>34</b>	aromatherapy	<b>72</b>	Mild cognitive impairment
<b>35</b>	support group	<b>73</b>	MCI
<b>36</b>	therap* group	<b>74</b>	mild neurocognitive disorder
<b>37</b>	memory group	<b>75</b>	<b>66 OR 67 OR 68 OR 69 OR 70 OR 71 OR 72 OR 73 OR 74 OR 75</b>
<b>38</b>	self help	<b>76</b>	<b>10 AND 59 AND 75</b>

## Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>TITLE</b>			
Title	1	Identify the report as a scoping review.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	2
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	5-6
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	6
<b>METHODS</b>			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	6
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	7-8
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	8
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Table 1
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	8-9
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	9
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	9
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	9



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>RESULTS</b>			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	9-10 and Figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	10 and Table 2
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Not feasible
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	10-13
<b>DISCUSSION</b>			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	13-14
Limitations	20	Discuss the limitations of the scoping review process.	16-17
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	17
<b>FUNDING</b>			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	18

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

\* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* ;169:467–473. doi: 10.7326/M18-0850



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# BMJ Open

## Outcomes tested in non-pharmacological interventions in mild cognitive impairment and mild dementia: a scoping review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-035980.R2
Article Type:	Original research
Date Submitted by the Author:	05-Feb-2020
Complete List of Authors:	Couch, Elyse; King's College London, Health Service and Population Research Lawrence, Vanessa; King's College London, Health Service and Population Research Co, Melissa; King's College London, Health Service and Population Research Prina, A. Matthew; King's College London, Health Service and Population Research
<b>Primary Subject Heading</b>:	Mental health
Secondary Subject Heading:	Geriatric medicine
Keywords:	Dementia < NEUROLOGY, Old age psychiatry < PSYCHIATRY, STATISTICS & RESEARCH METHODS

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3 **Outcomes tested in non-pharmacological interventions in mild cognitive impairment and**  
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6 **mild dementia: a scoping review**  
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11 Elyse Couch<sup>1\*</sup>, Vanessa Lawrence<sup>1</sup>, Melissa Co<sup>1</sup>, and A. Matthew Prina<sup>1</sup>  
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## Abstract

Objectives: Non-pharmacological treatments are an important aspect of dementia care. A wide range of interventions have been trialled for mild dementia and mild cognitive impairment (MCI). However, the variety of outcome measures used in these trials makes it difficult to make meaningful comparisons. The objective of this study is to map trends in which outcome measures are used in trials of non-pharmacological treatments in MCI and mild dementia.

Design: Scoping Review

Data Sources: EMBASE, Psych Info, Medline and the Cochrane Register of Controlled Trials were searched from inception until February 2018. An additional search was conducted in April 2019

Eligibility: We included RCTs testing non-pharmacological interventions for people diagnosed with MCI or mild dementia. Studies were restricted to full RCTs; observational, feasibility and pilot studies were not included.

Charting Methods: All outcome measures used by included studies were extracted and grouped thematically. Trends in the types of outcome measures used were explored by type of intervention, country and year of publication.

Results: 91 studies were included in this review. We extracted 358 individual outcome measures, of which 78 (22%) were used more than once. Cognitive measures were the most frequently used, with the MMSE being the most popular.

Conclusions: Our findings highlight an inconsistency in the use of outcome measures. Cognition has been prioritised over other domains, despite previous research highlighting the importance of quality of life and caregiver measures. To ensure a robust evidence base, more research is needed to highlight which outcome measures should be used over others.

Protocol Registration: The protocol for this study was registered on PROSPERO (ID: CRD42018102649).

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9 **Strengths and Limitations of this study:**  
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- 11
- 12 • This scoping review has systematically mapped which outcome measures have been used by  
13 randomised controlled trials testing non-pharmacological treatments in mild dementia and  
14 mild cognitive impairment.  
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  - 17 • This review has explored how the use of outcome measures varies by diagnosis, type of  
18 intervention, country and year of publication.  
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  - 21 • The papers included in this review were limited to full randomised controlled trials, other  
22 study designs may be using different types of outcome measures.  
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  - 25 • Further research is needed to establish which measures should be used over others.  
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## Introduction

Delivery of both pharmacological and non-pharmacological treatment in the early stages of dementia has been identified as a global priority<sup>1,2</sup>. Current pharmacological treatments for the cognitive symptoms of dementia have been found to have a greater effect when delivered as early as possible<sup>3</sup>. However, the benefits of delivering non-pharmacological treatments early are less well understood. Non-pharmacological treatments are an important clinical tool for managing dementia as they are more acceptable to some and less prone to side effects, making them a safe alternative to drug treatments<sup>4</sup>. Those diagnosed earlier in the disease have more cognitive abilities available to engage with non-pharmacological treatments and bolster their own methods for coping with the disease<sup>5</sup>. Previous systematic reviews have found non-pharmacological treatments can improve outcomes; however, these reviews were restricted to a small number of outcome measures<sup>6,7</sup>.

Mild cognitive impairment (MCI) has been identified as a potential prodrome for dementia, with approximately 10% of people with MCI converting to a diagnosis of dementia per annum<sup>8</sup>. There is an interest in MCI, as a diagnosis of MCI can facilitate an early diagnosis of dementia and therefore earlier access to dementia services and treatment<sup>9</sup>. MCI is a potentially reversible condition, with many people with MCI reverting back to normal levels of cognition<sup>9</sup>. Therefore, it is important treatments are available. However, it is not clear which treatments can reverse MCI or prevent conversion to dementia<sup>3</sup>. No drug treatments for MCI have been found to be effective<sup>10,11</sup> and acetylcholinesterase inhibitors are not recommended, however, there is some limited evidence that non-pharmacological interventions may be beneficial<sup>3,12</sup>.

Randomised Controlled Trials (RCTs) testing non-pharmacological treatments in dementia and MCI are becoming more common. However, they are highly heterogeneous in terms of participants recruited, quality of the study and the types of interventions they are testing, making it difficult to establish the effectiveness of one treatment over another<sup>6,12,13</sup>. Compounding these issues is the inconsistent use of outcome measures in this area of work<sup>9,14</sup>.

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3 Systematic reviews have identified possible benefits of non-pharmacological treatment, yet meta-  
4 analyses are difficult to conduct due to the variation in outcome measures used by studies and  
5 typically yield small to moderate effect sizes<sup>6 7</sup>. It is possible that these small effect sizes are due to  
6 the selection of outcome measures which either lack sensitivity or the change following the  
7 intervention not being in the area covered by the outcome measure. It is important researchers are  
8 clear on which domains their interventions are targeting, and which measures are best able to  
9 capture this change<sup>15</sup>. Pharmacological treatments target specific biological pathways underlying  
10 the disease; therefore, outcome measures have been chosen to reflect this and typically focus on  
11 cognitive and functional decline<sup>16</sup>. Non-pharmacological treatments generally do not target the  
12 underlying biological pathway of the disease therefore, outcome measures should theoretically  
13 differ between pharmacological and non-pharmacological treatments<sup>17</sup>. However, a review on non-  
14 pharmacological approaches to treating found that studies tended to pay little attention to the  
15 mechanisms of change underlying the intervention<sup>4</sup>. The expected mechanisms of change should  
16 affect which outcomes are used in non-pharmacological treatments for mild dementia and MCI.  
17  
18 In addition to being clear on how change arises in non-pharmacological treatments, there needs to  
19 be a more coherent use of outcomes and the measures used to capture these between studies to  
20 ensure a broad and robust evidence base<sup>15</sup>. In 2008, the INTERDEM group, a consortium of  
21 dementia researchers across Europe, did work to draw a consensus on which outcome measures  
22 should be used when evaluating non-pharmacological treatments. They recommended 22 measures  
23 across nine domains including quality of life, mood, global functioning, behaviour, daily living skills,  
24 caregiver mood, caregiver burden and staff morale<sup>15</sup>. This guidance does not explore outcomes by  
25 the stage of the disease. The outcome measures were selected based on their applicability to  
26 European research. The utility of outcome measures may vary by culture<sup>16</sup>, previous reviews  
27 exploring the use of outcome measures in dementia research have not investigated how this differs  
28 by country<sup>17</sup>.

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3 It is not understood which outcome measures are currently being used in non-pharmacological  
4 treatments for early dementia and MCI. Scoping reviews present the opportunity to map the  
5 evidence on a topic <sup>18</sup>, unlike a systematic review scoping reviews can be used to summarise the  
6 evidence in a heterogeneous body of literature. Therefore, the aim of this scoping review is to map  
7 trends in which outcome measures are being used in RCTs for non-pharmacological treatments in  
8 MCI and mild dementia.  
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### 16 *Objectives*

17 The specific objectives of this scoping review are to:

- 18 (1) Chart which outcomes measures have been used to assess the effectiveness of  
19 nonpharmacological treatments in mild dementia and MCI
- 20 (2) Highlight which types of measures have been used most frequently
- 21 (3) Explore whether the outcome measures used differ depending on the type of intervention,  
22 study population, and country the research was conducted in.

### 23 **Methods**

#### 24 *Protocol registration*

25 The protocol for this review was developed following the guidelines set out by the Preferred  
26 Reporting Items for Systematic Reviews and Meta-Analysis Extension (PRISMA) statement <sup>19</sup> and the  
27 PRISMA guidelines for Scoping Reviews (PRISMA-ScR) <sup>18</sup>. The protocol was registered prospectively  
28 on PROSPERO (ID: CRD42018102649).  
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#### 35 *Eligibility criteria*

36 We included RCTs testing non-pharmacological interventions for people diagnosed with MCI or mild  
37 dementia. Studies were restricted to full RCTs; observational, feasibility and pilot studies were not  
38 included.  
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3 Studies were included if they met the following criteria:  
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- 6 • Testing non-pharmacological interventions. Studies were not excluded if participants were  
7 also treated with acetylcholinesterase inhibitors.  
8
- 9 • Participants had a diagnosis of MCI or mild dementia, which was either diagnosed in clinical  
10 practice, or met standardised diagnostic criteria, such as the International Statistical  
11 Classification of Diseases (ICD-10) or The Diagnostic Statistical Manual of Mental Disorders  
12 (DSM), The National Institute of Communicative disorders and Stroke and the Alzheimer's  
13 Disease and Related Disorders (NINCDS-ADRDA), the International working group on MCI  
14 criteria, The Consortium to Establish a Registry for Alzheimer's Disease (CERAD), The  
15 National Institute on Aging- Alzheimer's Associating Diagnostic Guidelines for Alzheimer's  
16 Disease, the Petersen Criteria; or was defined by a standardised clinical measure, such as  
17 scores between 24-18 on the Mini-Mental State Exam (MMSE); scores  $\leq 26$  on the Montreal  
18 Cognitive Assessment (MoCA), scores between 15-27 on the St Louis University Mental  
19 Status (SLUMS), a Clinical Dementia Rating (CDR) score of 1 (for dementia) or 0.5 (for MCI);  
20 or a 4 (for dementia) or 3 (for MCI) on the Global Deterioration Scale (GDS). Studies which  
21 include a mix of participants with early dementia and MCI were included, however, studies  
22 which included healthy participants and participants with dementia at the later stages of the  
23 disease were excluded.  
24
- 25 • The intervention was targeted for the person living with dementia or MCI. Dyadic  
26 interventions, interventions delivered to both the person living with dementia and their  
27 caregivers, were included. Interventions delivered solely to caregivers or health care  
28 professionals were excluded.  
29
- 30 • Participants were living in long term care facilities or the community  
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- 32 • Written in English  
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58 Studies were excluded if:  
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- Only pharmacological interventions were tested
- The participants were diagnosed with vascular cognitive impairment, young-onset dementia, Parkinson's Disease Dementia, or MCI with Parkinson's Disease
- Participants were living in a psychiatric inpatient or acute hospital setting
- The intervention had the primary aim of treating major depressive disorder
- The study tested palliative care interventions or advanced care planning
- The only outcome measures used were economic outcomes, such as cost-effectiveness etc.

#### *Information sources and search strategy*

To identify potentially relevant studies, we searched EMBASE, Psych Info, Medline and the Cochrane Register of Controlled Trials from inception until 22<sup>nd</sup> February 2018. An additional search was conducted on 2<sup>nd</sup> April 2019. See **Supplementary Table 1** for the final search strategy for MEDLINE, which was adapted for the other databases. The final search results were exported into EndNote where duplicates were removed.

Additional papers were identified by searching the references of included papers and other systematic reviews. Conference abstracts and publications were not included.

#### *Selection of sources of evidence*

Study selection was managed in Rayyan, where citations were screened against the inclusion and exclusion criteria. Rayyan is an online app for systematic reviews which allows researchers to create their own coding system for decision making<sup>20</sup>. References were first screened by title and abstract, followed by a full-text screening. A second reviewer (MC) screened 10% of the articles at each stage of the review. Disagreements were resolved by discussions with a third reviewer (MP).

A critical appraisal or assessment of the risk of bias is not necessary for a scoping review<sup>18</sup>. This scoping review is not aiming to critically appraise the cumulative literature of outcome measures for

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2  
3 non-pharmacological treatment in MCI and mild dementia, therefore we did not conduct a critical  
4 appraisal or risk of bias assessment for this review.  
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#### 7 8 *Data charting process and data items* 9

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11 Data from eligible studies were charted using a standardised extraction tool designed for this study.  
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13 Items deemed most relevant to the review objectives were the diagnosis of the study participants,  
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15 description of interventions being tested, the number of intervention groups, and outcome  
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17 measures used with references.  
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#### 20 21 *Synthesis of results* 22

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24 The charted data were mapped to reflect the objectives of this review. Following data charting,  
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26 outcome measures which were used more than once across the included studies were grouped by  
27  
28 domain. We grouped the interventions thematically by the type of intervention being tested.  
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31 We explored which types of outcome measures were used by intervention type, by tabulating the  
32  
33 type of intervention against the domain of the outcome measure. We excluded interventions which  
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35 were only used once from this summary. Results were presented in tables and summarised  
36  
37 narratively.  
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#### 40 41 *Patient and Participant Involvement* 42

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44 The South London and Maudsley MALADY group, of current and former carers of people living with  
45  
46 dementia, were consulted in the planning of this study.  
47

## 48 49 **Results** 50

### 51 52 *Included studies* 53

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55 After duplicates were removed, a total of 7,056 citations were screened for inclusion, 653 were  
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57 screened at full text and 76 papers were initially identified. A top-up search in April 2019 identified  
58  
59 119 new citations, 17 were included making the total number of included studies 91, See **Figure 1**.  
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3 The studies included in this review are described in **Table 1**, including diagnosis of included  
4 participants, number of intervention groups, details on the interventions and comparisons tested  
5 and the number of outcomes measures used. The included studies were published between 2002  
6 and 2019.  
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12 The majority of studies included in this review were conducted in the USA (n=10), Hong Kong (n=10),  
13 and Italy (n=10). Followed by mainland China (n=7), Japan (n=7), and South Korea (n=7). Studies  
14 were also conducted in: Argentina, Australia, Brazil, Canada, Czech Republic, Denmark, France,  
15 Finland, Germany, Greece, Hungary, Iran, Norway, Pakistan, Singapore, Spain, Taiwan, The  
16 Netherlands, Turkey, and the United Kingdom; these countries had fewer than 5 included studies  
17 each.  
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26 Most studies only recruited participants with MCI (n=72), followed by mild dementia only (n=15),  
27 and six studies recruited both participants with MCI and mild dementia.  
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### 32 *Results of individual sources of evidence*

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35 We extracted 358 individual outcome measures from the included studies, of these 78 (22%) were  
36 used more than once. Out of the 78 measures used more than once, 70 (88%) were measures of  
37 participants living with dementia (PLWD), 6 measures were used in both the PLWD and their  
38 caregiver, 2 measures were only of the caregiver. The number of outcome measures used by each  
39 study ranged between one and 21 with an average of 6.85.  
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### 47 *Types of non-pharmacological interventions*

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50 We grouped the interventions thematically by type. The most frequently tested type of intervention  
51 was cognitive training (n=36) followed by physical activity (n=25), combined physical activity and  
52 cognitive training (n=4), multicomponent psychosocial interventions (n=4) and support groups (n=3).  
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54 Animal-assisted therapies, art-based therapies, case management, Chinese calligraphy, music-based  
55 interventions and reminiscence therapy were each tested in two studies.  
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3 A group weight loss programme, mindfulness, social activities, transcranial direct current  
4 stimulation (TDS), transcutaneous electrical nerve stimulation (TENS), and Transcranial magnetic  
5 stimulation (TMS) were each trialled once. These interventions were not included in the analysis of  
6 trends in outcome measures.  
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### 10 11 12 *PLWD outcome measures*

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15 **Table 2** presents the PLWD specific outcome measures grouped by domain. The most frequently  
16 measured domain in PLWD was cognition/memory, which was measured 219 times across the 93  
17 included studies. The most frequent measure of cognition was the MMSE, which was measured 37  
18 times. In addition to measures of memory performance knowledge of memory strategies was  
19 measured 3 times in PLWD.  
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25 The next most frequently measured domain in PLWD was behavioural and psychological symptoms  
26 of dementia (BPSD), within this depression was the most commonly measured BPSD. The Geriatric  
27 Depression Scale was the most used measure in this domain, followed by the Neuropsychiatric  
28 Inventory which examines a greater number of symptoms. Other BSPDs measured were apathy and  
29 agitation resulting from memory problems.  
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35 Quality of life and wellbeing were measured 15 times across the included study. Quality of life was  
36 measured 15 times using four different instruments, the most popular of which was Logsdon's  
37 Quality of Life in Alzheimer's disease scale which was used seven times.  
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43 Measures of everyday living, physical ability, biological outcomes and adherence to the intervention  
44 delivered in the study were measured less than 20 times across the included studies.  
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### 48 49 50 *Caregiver measures*

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53 Eight interventions in this study were dyadic<sup>21-28</sup>, all included outcome measures specific to the  
54 caregiver in addition to the PLWD. One study of an intervention solely delivered to the PLWD also  
55 included a caregiver specific measure<sup>29</sup>.  
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3 **Table 2** also presents the outcome measures administered to caregivers grouped by domain. The  
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5 Center for Epidemiological Studies Depression Scale and the Zarit Caregiver Burden interview were  
6  
7 the only measures which were administered solely to caregivers. The other caregiver measures were  
8  
9 also administered to PLWD. The most frequently measured domain in caregivers was depression,  
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11 followed by caregiver burden. General wellbeing, knowledge of memory strategies, quality of life  
12  
13 and stress were each measured once.  
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#### 16 17 *Use of outcome measures over time*

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20 Randomised controlled trials of non-pharmacological treatments in mild dementia and MCI have  
21  
22 become more frequent over recent years. Almost half (48%) of studies included in this review were  
23  
24 published between 2016 and 2018.  
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28 **Figure 2** charts trends in outcome measure domains over time. As the number of studies in this area  
29  
30 has increased over time, so too has the use of outcome measures in all domains. Cognition/memory  
31  
32 has consistently been measured over other domains from the beginning of this sample. The only  
33  
34 noticeable trend change is in measures of BPSD, which was generally in line with other domains until  
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36 around 2012, when it overtakes other domains.  
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40 Nearly all studies in 2014 included a measure of everyday living; however, since then, the number of  
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42 studies including these measures has declined. Where measures of everyday living are being used  
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44 less, measures of BPSD are being used more.  
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48 Similarly, caregiver measures were consistently used until 2011, when in 2010 and 2011 all studies  
49  
50 included a caregiver measure, however since then the use of such measures has declined.  
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#### 52 *Use of outcome measures by intervention*

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55 **Table 3** presents diagnosis and type of intervention by the domains measured. Cognition/memory  
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57 was the most measured domain across all diagnostic groups, followed by BPSD. The third most  
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3 common domain for MCI studies was physical performance, whereas caregiver measures were the  
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5 third most common type of measures used in studies of early dementia,  
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8 Cognition/memory was measured in all types of intervention. Measures of BPSD were most common  
9  
10 in cognitive training interventions and physical activity interventions, however, they were not used  
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12 by combined cognitive and physical training interventions. Quality of life was measured by studies  
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14 of case management, cognitive training, psychosocial interventions, physical activity and support  
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16 groups.  
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20 Caregiver measures were used in five types of interventions. Case management, cognitive training  
21  
22 and psychosocial interventions; followed by arts-based therapy and support groups.  
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#### 25 *Use of outcome measures by country*

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28 **Table 4** presents the country the research was conducted in by outcome measure domain.  
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30 Generally, there was not too much variability in the domain of outcome measures used by country.  
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32 Cognition/memory was the domain most frequently measured by all countries, followed by BPSD.  
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34 The majority of studies were conducted in China (including Hong Kong and Taiwan), these studies  
35  
36 focused on cognition/memory, BPSD and biological outcome measures. Other than China, only three  
37  
38 other countries included biological measures (Iran, Pakistan and the USA). The USA had the second  
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40 largest number of studies included in this review, these studies favoured cognition/memory, BPSD,  
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42 caregiver measures and quality of life. Out of the 24 countries with studies included in this review,  
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44 less than half (n=9) included measures of quality of life.  
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#### 49 **Discussion**

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52 In this study, we used a scoping review to map which outcome measures had been used in trials for  
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54 non-pharmacological treatments of mild dementia and MCI. We extracted 358 individual outcome  
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56 measures used in 91 trials, only 22% of which were used more than once. We grouped the outcome  
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58 measures which had been used more than once and examined differences in their use over time, by  
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3 diagnostic group, country the research was set in and by the type of intervention they were being  
4 used to evaluate. Measures of cognition and BPSDs were the most frequently used across all studies  
5 and types of intervention.  
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10 Perhaps unsurprisingly, measures of cognition or memory are the most prevalent across all  
11 countries, diagnostic groups and types of intervention with the MMSE being the most frequently  
12 used outcome measure, despite the ADAS-cog having been validated as the gold-standard measure  
13 of cognition<sup>15 30 31</sup>. Measuring cognition is central to measuring the progression of dementia and is a  
14 clinically and empirically useful outcome to measure in dementia research<sup>31</sup>. However, in this  
15 review, we charted 40 different measures of cognition. This indicates that while cognition has been  
16 prioritised as an outcome in studies of non-pharmacological interventions, there is no consensus  
17 between researchers on which specific measures should be used. In addition to measures of  
18 cognitive performance, three studies have also measured participant's knowledge or retention of  
19 memory strategies, indicating an interest in longer-term coping strategies for memory loss.  
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33 Measures of the BPSD have become more common over time, becoming in 2017 the most measured  
34 outcome after cognition. There is not much variety in the BPSDs which have been measured.  
35 Generally, depression was measured over other BPSDs. Other BPSDs such as agitation were  
36 measured less, perhaps because they are more associated with the later stages of the disease and  
37 depression is associated with the earlier stages<sup>32</sup>.  
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45 Quality of life and wellbeing were not amongst the most measured domains. Four measures of  
46 quality of life were used 13 times across the included studies and all but one of these measures were  
47 dementia specific measures. It is surprising quality of life has not been measured more, as previous  
48 research has stated that in the absence of a cure, health care providers have a greater ability to  
49 improve quality of life than alter the progression of the disease<sup>33</sup>. Furthermore, both people with  
50 MCI and caregivers rated quality of life of the patient as the most important outcome to measure,  
51 followed by caregiver quality of life/burden<sup>34</sup>. Indicating while quality of life has been identified as a  
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3 priority by PLWD, people diagnosed with MCI and their caregivers in previous research, the findings  
4 of this study shows this is not being translated into trials of non-pharmacological treatments for  
5  
6 early dementia and MCI.  
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10 Likewise, caregiver measures had consistent low use across the studies included in this review. We  
11  
12 charted eight caregiver measures which were used 11 times across the included studies. Caregiver  
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14 measures were more commonly used in studies of PLWD, rather than MCI. Previous research has  
15  
16 highlighted the profound effect of dementia on their caregivers, with around half of caregivers  
17  
18 experiencing high levels of burden <sup>35</sup>. However, a third of caregivers of people with MCI also report  
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20 extreme levels of burden <sup>36</sup>, yet the findings of this study show this is less investigated.  
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23  
24 There was great variability in the types of outcomes being used to evaluate the different types of  
25  
26 intervention. All studies measured cognition and all but one measured BPSD. A lack of clarity in how  
27  
28 change occurs as a result of non-pharmacological treatments is a fundamental weakness in this area  
29  
30 of work <sup>4</sup>. It is unlikely that all interventions being tested in this review could hope to improve  
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32 cognition, however this is the most prevalent domain of outcome measures. There are a number of  
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34 practical reasons as to why certain outcomes, and therefore outcome measures are used over  
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36 others, In the past, pharmacological treatments have been required to include some measure of  
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38 cognition, functional or global assessment<sup>17</sup>, it is possible that this approach has influenced the  
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40 choice in outcomes used in non-pharmacological studies. Furthermore, some measures may be used  
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42 over others for more practical reasons. For example, measures which are short to administer and  
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44 free to use may be priorities over others<sup>31</sup>. Several interventions in this review comprise of more  
45  
46 than one component, e.g. physical activity and cognitive training. In these cases, it may take multiple  
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48 measures over many domains to accurately capture change. It is vital that outcome measures are  
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50 selected depending on the domains the intervention is seeking to address <sup>31</sup>.  
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56 In 2008, the INTERDEM group recommended 22 outcome measures for use across nine domains <sup>15</sup>.

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58 We found 11 of these 22 measures (50%) were used by the studies included in this review, one of  
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3 the recommended domains (staff carer morale) was not applicable to the studies included in this  
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5 review. All measures recommended for measuring patient mood, and patient quality of life were  
6  
7 charted in this review. Only one of the recommended measures for the activities of daily living,  
8  
9 caregiver mood, caregiver burden and caregiver quality of life domains were charted and no  
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11 measures under the global measures domain were charted in this review. This indicates that there is  
12  
13 some consistency between which measures are recommended and which measures are utilised, this  
14  
15 is largely for patient measures and there is less consistency for caregiver measures.  
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19 In this study, we found that the use of outcome measures did not vary much by the country the  
20  
21 study was conducted in. In each country, cognition/memory was the most commonly tested domain,  
22  
23 followed by BPSD. The importance of outcomes may vary between cultures; therefore, it is  
24  
25 important that the outcomes and measures used reflect this <sup>16</sup>. However, due to the limitations of  
26  
27 the methodology used we cannot comment on the cultural relevance of the outcome measures  
28  
29 charted in this review. Furthermore, articles were only included if they were published in English. It  
30  
31 is possible that more culturally appropriate outcomes were used in articles published in the same  
32  
33 language as the population under investigation. This is an important area for future research.  
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### 37 38 *Limitations*

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41 The findings of this review must be interpreted in the context of the study. To make this review  
42  
43 feasible we only included full RCTs, other outcome measures may have been used in different types  
44  
45 of studies. Due to time constraints, some sub-types of dementia and cognitive impairment (young-  
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47 onset, Parkinson's disease dementia and vascular cognitive impairment) were excluded from this  
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49 review, which limits the applicability of these findings. Further research is needed to explore  
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51 whether the pattern in the use of outcomes and outcome measures is similar in these groups,  
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53 compared with the ones included in this review. Furthermore, only outcome measures which were  
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55 published could be included in this review. The studies included in this study were heterogeneous in  
56  
57 terms of participants recruited, interventions tested, and outcome measures used, making it difficult  
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3 to group them thematically. It is possible some nuance is lost in the exploration of broader themes.  
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5 As with the nature of scoping reviews, we are only able to present which outcome measures have  
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7 been used in previous research, we are unable to draw conclusions as to which outcome measures  
8  
9 should be used over others. Future research should explore which populations measures have been  
10  
11 validated for and what constitutes a clinically useful change.  
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#### 14 15 *Implications and recommendations for future research*

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18 The findings of this review indicate there is very little consistency in outcome measures used in RCTs  
19  
20 for non-pharmacological interventions in MCI and mild dementia, however we are not able to  
21  
22 conclude which measures should be used over others. To create a strong evidence base for non-  
23  
24 pharmacological treatments more research, with the involvement of PLWD and their carers, is  
25  
26 needed to determine which measures are preferable over a greater number of domains.  
27  
28 Additionally, the prevalence of cognitive measures found in this study, suggests that researchers are  
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30 including such measures because there is an expectation to do. Researchers should be clear on the  
31  
32 theory behind how their intervention creates change and use the appropriate outcome measures.  
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#### 36 37 **Conclusions**

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39 In summary, this study has found RCTs for non-pharmacological treatments in mild dementia and  
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41 MCI use a broad range of outcome measures, with a small proportion being used more than once.  
42  
43 Excepting measures of cognition, there is very little commonality between studies. Where previous  
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45 research has set priorities on outcomes preferred by PLWD, people with MCI and caregivers, quality  
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47 of life for example, this has not yet translated into studies measuring new treatments. Further  
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49 research is needed to understand which outcomes should be prioritised and how they should be  
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51 measured.  
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#### 54 55 56 **Contributors**

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3 EC designed the study, carried out the literature review, the data charting and synthesis, data  
4 interpretation, article preparation, article review and correspondence. AMP and VL contributed to  
5 the study design, data interpretation, and article review. MC contributed to the data charting.  
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### 22 **Data availability statement**

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36 memory training and yoga interventions in older adults with mild cognitive impairment.  
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40 cognitive function, physical performance and muscle strength in older women with mild  
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59 impairment. *Clinical interventions in aging* 2018;13:1691.  
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**Table 1. Included Studies**

Lead Author	Year	Country	Diagnosis	Number of Groups	Group 1	Group 2	Group 3	Group 4	Group 5	Number of measures
Amjad <sup>37</sup>	2019	Pakistan	MCI	2	Aerobic Exercise	Non-Aerobic Exercise	-	-	-	4
Bae <sup>38</sup>	2019	Japan	MCI	2	Multi-Intervention Programme	Active Control	-	-	-	10
Baker <sup>39</sup>	2010	USA	MCI	2	Aerobic Exercise	Stretching	-	-	-	11
Belleville <sup>40</sup>	2018	Canada	MCI	3	Cognitive Training	Psychosocial Intervention	Control	-	-	7
Biasutti <sup>41</sup>	2017	Italy	MCI	2	Cognitive Training	Gym Activities	-	-	-	4
Bono <sup>42</sup>	2015	Italy	MCI	2	Animal Assisted Therapy	Control	-	-	-	4
Burgio <sup>43</sup>	2018	Italy	MCI	2	Numerical Training	Executive Training	-	-	-	13
Buschert <sup>44</sup>	2012	Germany	MCI	2	Cognitive Training	Active Control	-	-	-	5
Carretti <sup>45</sup>	2013	Italy	MCI	2	Cognitive Training	Active Control	-	-	-	16
Cavallo <sup>46</sup>	2016	Italy	Dementia	2	Cognitive Training	Active Control	-	-	-	3
Chan <sup>47</sup>	2016	Hong Kong	MCI	2	Chinese Calligraphy	Computer Activities	-	-	-	13
Chan <sup>48</sup>	2017	Hong Kong	MCI	2	Chinese Calligraphy	Computer Activities	-	-	-	8
Choi <sup>49</sup>	2018	South Korea	MCI	2	Ground Kayaking	Home Exercise Education	-	-	-	7
Combourieu Donnezan <sup>50</sup>	2018	France	MCI	4	Physical Training	Cognitive Training	Simultaneous Cognitive and Physical Training	Control	-	4
DiNapoli <sup>51</sup>	2016	USA	MCI	2	Individualised Social Activities	Control	-	-	-	4
Doi <sup>52</sup>	2013	Japan	MCI	2	Exercise	Active Control	-	-	-	4
Doi <sup>53</sup>	2017	Japan	MCI	3	Dance	Playing Musical Instruments	Health Education Group	-	-	4
Drumond Marra <sup>54</sup>	2015	Brazil	MCI	2	TMS	Sham TMS	-	-	-	6
Emsaki <sup>55</sup>	2017	Iran	MCI	2	Cognitive Training	Active Control	-	-	-	9
Eyre <sup>56</sup>	2017	USA	MCI	2	Yoga	Cognitive Training	-	-	-	10
Feng <sup>57</sup>	2018	China	MCI	2	Single Component Cognitive Training	Multiple Component Cognitive Training	-	-	-	3
Fernandez-Calvo <sup>58</sup>	2015	Spain	Dementia	2	Multi-Intervention Programme	Control	-	-	-	21
Fiatarone Singh <sup>59</sup>	2014	Australia	MCI	4	Progressive resistance training and sham cognitive training	Progressive resistance training and cognitive training	Cognitive training	Control	-	12

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1											
2											
3	Finn <sup>60</sup>	2015	Australia	MCI	2	Repetition-lag Training	Control	-	-	-	6
4	Fogarty <sup>61</sup>	2016	Canada	MCI	2	Memory Intervention Program and Tai Chi	Memory Intervention Program	-	-	-	5
5											
6	Forster <sup>62</sup>	2011	Germany	Both	2	Cognitive Training	Control	-	-	-	10
7	Galante <sup>63</sup>	2007	Italy	Dementia	2	Cognitive Training	Active Control	-	-	-	12
8	Greenaway <sup>21</sup>	2013	USA	MCI	2	Memory Support System (Memory Rehabilitation) with Training	Memory Support System without Training	-	-	-	15
9											
10											
11	Hagovska <sup>64</sup>	2017	Czech Republic	MCI	2	Cognitive Training (Computer Based)	Cognitive Training	-	-	-	0
12											
13	Hagovska <sup>65</sup>	2016	Czech Republic	MCI	2	Cognitive Training and Dynamic Balance Training	Balance Training	-	-	-	4
14											
15	Han <sup>66</sup>	2017	South Korea	MCI	2	Ubiquitous Spaced Retrieval-based Memory Advancement and Rehabilitation Training	Control	-	-	-	4
16											
17											
18											
19	Han <sup>67</sup>	2017	South Korea	Both	2	Multimodal Cognitive Enhancement Therapy	Active Control	-	-	-	7
20											
21	Hattori <sup>29</sup>	2011	Japan	Dementia	2	Art Therapy	Active Control	-	-	-	4
22	Ho <sup>68</sup>	2018	Hong Kong	Both	3	Dance Movement Therapy	Physical Exercise	Control	-	-	7
23	Horie <sup>69</sup>	2016	Brazil	MCI	2	Group Weight Loss Programme	Control	-	-	-	10
24											
25	Hyer <sup>70</sup>	2016	USA	MCI	2	Cognitive Training (Computer Based)	Active Control	-	-	-	3
26											
27	Jansen <sup>22</sup>	2011	The Netherlands	Dementia	2	Case Management	Control	-	-	-	5
28											
29	Jean <sup>71</sup>	2010	Canada	MCI	2	Cognitive Training	Active Control	-	-	-	10
30	Jelcic <sup>72</sup>	2012	Italy	Dementia	2	Lexical-Semantic Treatment	Cognitive Stimulation	-	-	-	11
31	Jeong <sup>73</sup>	2016	South Korea	MCI	2	Cognitive Intervention (Group based)	Cognitive Intervention (Home Based)	-	-	-	8
32											
33	Kinsella <sup>23</sup>	2009	Australia	MCI	2	Cognitive Intervention	Control	-	-	-	4
34	Kohanpour <sup>74</sup>	2017	Iran	MCI	4	Aerobic Exercise	Lavender Extract	Aerobic Exercise and Lavender Extract	Control	-	14
35											
36	Koivisto <sup>24</sup>	2016	Finland	Dementia	2	Psychosocial Intervention	Control	-	-	-	7
37	Kovacs <sup>75</sup>	2013	Hungary	MCI	2	Multimodal Exercise	Control	-	-	-	1
38	Kuster <sup>76</sup>	2016	Germany	MCI	3	Cognitive Training	Physical Training	Control	-	-	7
39	Kwok <sup>77</sup>	2012	Hong Kong	MCI	2	Cognitive Training	Active Control	-	-	-	5
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3	Lam <sup>78</sup>	2012	Hong Kong	MCI	2	Tai Chi	Stretching	-	-	-	-	-	4
4	Lam <sup>79</sup>	2015	Hong Kong	MCI	4	Cognitive Training	Cognitive and Physical Training	Physical Training	Social Groups	-	-	-	2
5													
6	Lam <sup>25</sup>	2010	Hong Kong	Dementia	2	Case Management	Control	-	-	-	-	-	2
7	Langoni <sup>80</sup>	2019	Brazil	MCI	2	Group Exercise	Control	-	-	-	-	-	14
8	Law <sup>81</sup>	2014	Hong Kong	MCI	2	Functional Tasks Exercise Programme	Cognitive Training	-	-	-	-	-	7
9													
10	Lazarou <sup>82</sup>	2017	Greece	MCI	2	Ballroom Dancing	Control	-	-	-	-	-	5
11	Li <sup>83</sup>	2019	China	MCI	2	Computerised Cognitive Training	Control	-	-	-	-	-	4
12													
13	Lim <sup>84</sup>	2018	Singapore	MCI	2	Mindfulness	Health Education	-	-	-	-	-	5
14	Logsdon <sup>26</sup>	2010	USA	Dementia	2	Early Stage Memory Loss Support Group	Control	-	-	-	-	-	10
15													
16	Luijpen <sup>85</sup>	2005	The Netherlands	MCI	2	TENS	Sham TENS	-	-	-	-	-	6
17													
18	Maffei <sup>86</sup>	2017	Italy	MCI	2	Multidomain Training	Control	-	-	-	-	-	10
19	Manav <sup>87</sup>	2019	Turkey	Dementia	2	Reminiscence Therapy	Social Interview	-	-	-	-	-	6
20													
21	Melendez <sup>88</sup>	2015	Spain	Both	2	Reminiscence Therapy	Control	-	-	-	-	-	6
22	Nagamatsu <sup>89</sup>	2012	Canada	MCI	2	Aerobic Exercise	Resistance Training	-	-	-	-	-	13
23	Olsen <sup>90</sup>	2016	Norway	Both	2	Animal Assisted Therapy	Control	-	-	-	-	-	9
24	Pantoni <sup>91</sup>	2017	Italy	MCI	2	Attention Process Training	Control	-	-	-	-	-	4
25	Park <sup>92</sup>	2018	South Korea	MCI	2	Cognition specific computer training	Non-specific computer training	-	-	-	-	-	5
26													
27	Poinsatte <sup>93</sup>	2019	USA	MCI	2	Aerobic Exercise	Stretching	-	-	-	-	-	3
28	Pongan <sup>94</sup>	2017	France	Dementia	2	Choral Singing	Painting	-	-	-	-	-	14
29	Poptsi <sup>95</sup>	2018	Greece	MCI	5	Paper Language Tasks	Computer Language Tasks	Oral Language Tasks	Active Control	-	-	-	4
30													
31	Qi <sup>96</sup>	2019	China	MCI	2	Aerobic Exercise	Control	-	-	-	-	-	3
32	Rapp <sup>97</sup>	2002	USA	MCI	2	Memory Enhancement Training (Multi-Component)	Control	-	-	-	-	-	9
33													
34													
35	Rojas <sup>98</sup>	2013	Argentina	MCI	2	Cognitive Intervention	Control	-	-	-	-	-	8
36	Rozzini <sup>99</sup>	2007	Italy	MCI	2	Cognitive Training and AChEIs	AChEIs	-	-	-	-	-	7
37													
38	Savulich <sup>100</sup>	2017	UK	MCI	2	Cognitive Training	Control	-	-	-	-	-	9
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Scherder <sup>101</sup>	2010	The Netherlands	MCI	3	Walking	Hand and Face Exercises	Control	-	-	11
Shimada <sup>102</sup>	2017	Japan	MCI	2	Physical and Cognitive Training	Health Education Group	-	-	-	7
Shimizu <sup>103</sup>	2017	Japan	MCI	2	Movement Music Therapy	Single Training Task	-	-	-	4
Simon <sup>104</sup>	2018	Brazil	MCI	2	Memory Training	Active Control	-	-	-	8
Song <sup>105</sup>	2019	China	MCI	2	Aerobic Exercise	Active Control	-	-	-	4
Suzuki <sup>106</sup>	2012	Japan	MCI	2	Multicomponent Exercise Group	Active Control	-	-	-	6
Tappen <sup>27</sup>	2014	USA	Both	2	Cognitive Training (Home Based)	Life Story Interview	-	-	-	11
Troyer <sup>107</sup>	2008	Canada	MCI	2	Multicomponent Intervention	Control	-	-	-	6
Tsai <sup>108</sup>	2018	Taiwan	MCI	3	Aerobic Exercise	Resistance Training	Control	-	-	7
Tsantali <sup>109</sup>	2017	Greece	Dementia	3	Cognitive Training	Cognitive Stimulation	Control	-	-	5
van Uffelen <sup>110</sup>	2007	The Netherlands	MCI	4	Walking	Placebo Activity	Folic Acid/Vitamin B Supplements	Placebo Pills	-	3
Waldorff <sup>28</sup>	2012	Denmark	Dementia	2	Multifaceted Counselling, Education and Support	Control	-	-	-	2
Wej <sup>111</sup>	2014	China	MCI	2	Handball Training	Control	-	-	-	8
Yang <sup>112</sup>	2016	USA	MCI	2	Memory Enhancement Training	Yoga	-	-	-	3
Yoon <sup>113</sup>	2017	South Korea	MCI	2	High-Speed Power Strength Training	Low-Speed Strength Training	-	-	-	5
Young <sup>114</sup>	2014	Hong Kong	Dementia	2	Support Groups	Control	-	-	-	4
Young <sup>115</sup>	2017	Hong Kong	MCI	2	Holistic Health Group	Control	-	-	-	4
Yun <sup>116</sup>	2016	South Korea	MCI	2	TDS	Sham TDS	-	-	-	1
Zhao <sup>117</sup>	2018	China	MCI	2	Creative Expression Therapy	Cognitive Training	-	-	-	7
Zhu <sup>118</sup>	2018	China	MCI	2	Dance	Control	-	-	-	7

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**Table 2. Outcome measures by domain and subdomains**

<b>Person living with dementia measures</b>		<b>N</b>
<b>Domain and subdomain</b>	<b>Outcome Measure</b>	
<b>Cognition/Memory</b>		<b>219</b>
Cognition	MMSE	37
	Trail Making Test	27
	Digit Span Test	12
	ADAS-Cog	10
	Rey Auditory Test	9
	Rivermead Behavioural Memory Test	9
	Stroop Test	7
	MMQ	7
	Novelli Lexical Test	7
	MoCA	6
	CDR	6
	Verbal Fluency	6
	CERAD-NB	5
	Addenbrooke's Cognitive Examination	4
	Boston Naming Test	4
	Rey Osterrieth Complex Figure Task	4
	Montreal Cognitive Test	3
	Attentional Matrices Test	3
	California Verbal Learning Test	3
	Digit Symbol Coding Test	3
	Hopkins Verbal Learning Test	3
	The Wechsler Memory Scale	3
	CAMcog	2
	Cognitive Failures Test	2
	Color Trails Test	2
	Dementia Rating Scale-2	2
	DSM IV Test	2
	Auditory Verbal Learning Test	2
	Corsi's Block Tapping Test	2
	Frontal Assessment Test	2
	Fuld Object Memory Evaluation	2
	Logical Memory (Subtest of Wechsler Memory Scale)	2
	Prospective and Retrospective Memory Questionnaire	2
	Pyramids & Palm Trees	2
	Questionnaire d'Auto Evaluation de la Memoire	2
	Raven's Coloured Matrices	2
	Repeatable Battery Test	2
	The verbal learning and memory test	2
	Visual Memory Span	2
	Wechsler Adult Intelligence Scale	2
Knowledge of Memory Strategies	Memory Strategy Toolbox	2
	Strategy Knowledge Repertoire	1
Attention	Test of Everyday Attention	2
<b>Behavioural and Psychological Symptoms of dementia</b>		<b>51</b>
Anxiety/Depression	Geriatric Depression Scale*	21
	Cornell Scale for Depression in Dementia*	7

	Hospital Anxiety and Depression Scale	4
	Beck Depression Inventory	1
Other	Neuropsychiatric Inventory*	12
	Apathy Evaluation Scale	3
	Revised Memory and behaviour problem checklist*	
<b>Everyday Living</b>		<b>20</b>
Activities of daily Living	Instrumental Activities of Daily Living*	8
	Bayer Activities of Daily Living Scale	3
	Alzheimer's Disease Cooperative Study Activities of Daily Living Scale	2
	Barthel index	2
Functional Ability	Functional Activities Questionnaire	3
	Functional and Cognitive Assessment Test and Functional Rating Scale for Dementia	2
<b>Physical Outcomes</b>		<b>19</b>
Physical Performance	Timed Up and Go Test	7
	Gait	3
	Handgrip strength	3
	Stride	2
	Walking Speed	2
Physical Measures	Weight	2
<b>Quality of Life/Wellbeing</b>		<b>15</b>
Quality of Life	QoL in Alzheimer's Disease*	7
	Dementia Quality of Life Instrument*	3
	EuroQoL EQ 5D*	2
	EQ-VAS	1
Stress	Perceived Stress Scale	1
General Wellbeing	SF-36	1
<b>Biological Outcome</b>		<b>9</b>
Brain Activity	EEG	4
	MRI	2
Biomarker	BDNF	3
<b>Adherence to Intervention</b>		<b>2</b>
Adherence to intervention	Adherence	2
<b>Caregiver Measures</b>		
<b>Domain</b>	<b>Outcome Measure</b>	<b>N</b>
<b>Depression</b>		<b>5</b>
	The Center for Epidemiological Studies Depression Scale*	3
	Geriatric Depression Scale	1
	Beck Depression Inventory	1
<b>Caregiver Burden</b>		<b>2</b>
	Zarit caregiver burden interview*	2
<b>General Wellbeing</b>		<b>1</b>
	Short Form Health Survey (SF-36)*	1
<b>Knowledge of Memory Strategies</b>		<b>1</b>
	Strategy Knowledge Repertoire	1
<b>Quality of Life</b>		<b>1</b>
	EQ-VAS	1

**Stress**

Perceived Stress Scale

**1**  
**1**

\*Measure recommended by INTERDEM Consensus [14]

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**Table 3. Outcome measure domain by diagnosis and intervention**

	Number of Studies	BPSD	Biological Outcome	Caregiver Measure	Cognition/Memory	Everyday Living	Physical Measures	Physical Performance	Quality of Life/Wellbeing	Task Performance
<b>Diagnosis</b>										
Both	6	5	-	1	12	1	-	-	-	-
Dementia	14	16	-	7	42	6	-	-	6	-
MCI	71	30	9	3	163	12	2	17	9	2
<b>Type of Intervention</b>										
Animal Assisted Therapy	2	2	-	-	2	1	-	-	-	-
Art-Based Therapy	2	1	-	1	6	1	-	-	-	-
Case Management	2	2	-	3	1	-	-	-	1	-
Chinese Calligraphy	2	1	1	-	4	-	-	-	-	-
Cognitive Training	37	23	2	3	103	11	-	1	6	2
Cognitive Training and Physical Activity	4	-	-	-	14	2	-	2	-	-
Multicomponent	4	6	-	3	10	2	-	2	3	-
Psychosocial Intervention	2	1	-	-	7	-	1	2	1	-
Music Based Intervention	2	1	-	-	7	-	1	2	1	-
Physical Activity	25	11	6	-	53	3	1	10	2	-
Reminiscence Therapy	2	1	-	-	2	-	-	-	-	-
Support Group	3	3	-	1	1	-	-	-	1	-

Table 4. Outcome measure domain by country

Country	Number of studies	BPSD	Biological Outcome	Caregiver Measure	Cognition/Memory	Functional ability	Physical Measures	Physical Performance	Quality of Life/Wellbeing	Task Performance
Argentina	1	1	0	0	6	1	0	0	0	0
Australia	4	0	0	1	5	1	0	0	0	0
Brazil	5	1	1	0	14	0	0	1	0	0
Canada	6	2	0	0	16	0	0	2	0	0
Mainland China, Hong Kong and Taiwan	20	10	5	1	35	2	0	0	0	1
Czech Republic	3	0	0	0	3	2	0	1	0	0
Denmark	1	2	0	2	1	1	0	0	2	0
Finland	1	1	0	1	3	1	0	0	1	0
France	3	1	0	0	6	0	0	2	1	0
Germany	4	1	0	0	10	0	0	0	1	0
Greece	4	3	0	0	18	2	0	0	1	0
Hungary	1	0	0	0	0	0	0	1	0	0
Iran	3	1	1	0	3	0	1	0	0	0
Italy	11	8	0	0	32	6	0	0	1	0
Japan	8	2	0	1	16	1	1	6	0	0
Norway	1	1	0	0	1	0	0	0	0	0
Pakistan	1	0	1	0	3	0	0	0	0	0
Singapore	1	0	0	0	0	0	0	0	0	0
South Korea	8	5	0	0	14	1	0	4	3	0
Spain	3	2	0	0	2	0	0	0	0	0
The Netherlands	5	0	0	2	10	0	0	0	2	0
Turkey	1	1	0	0	1	0	0	0	0	0
UK	1	3	0	0	1	0	0	0	0	0
USA	10	6	1	3	19	2	0	0	3	1

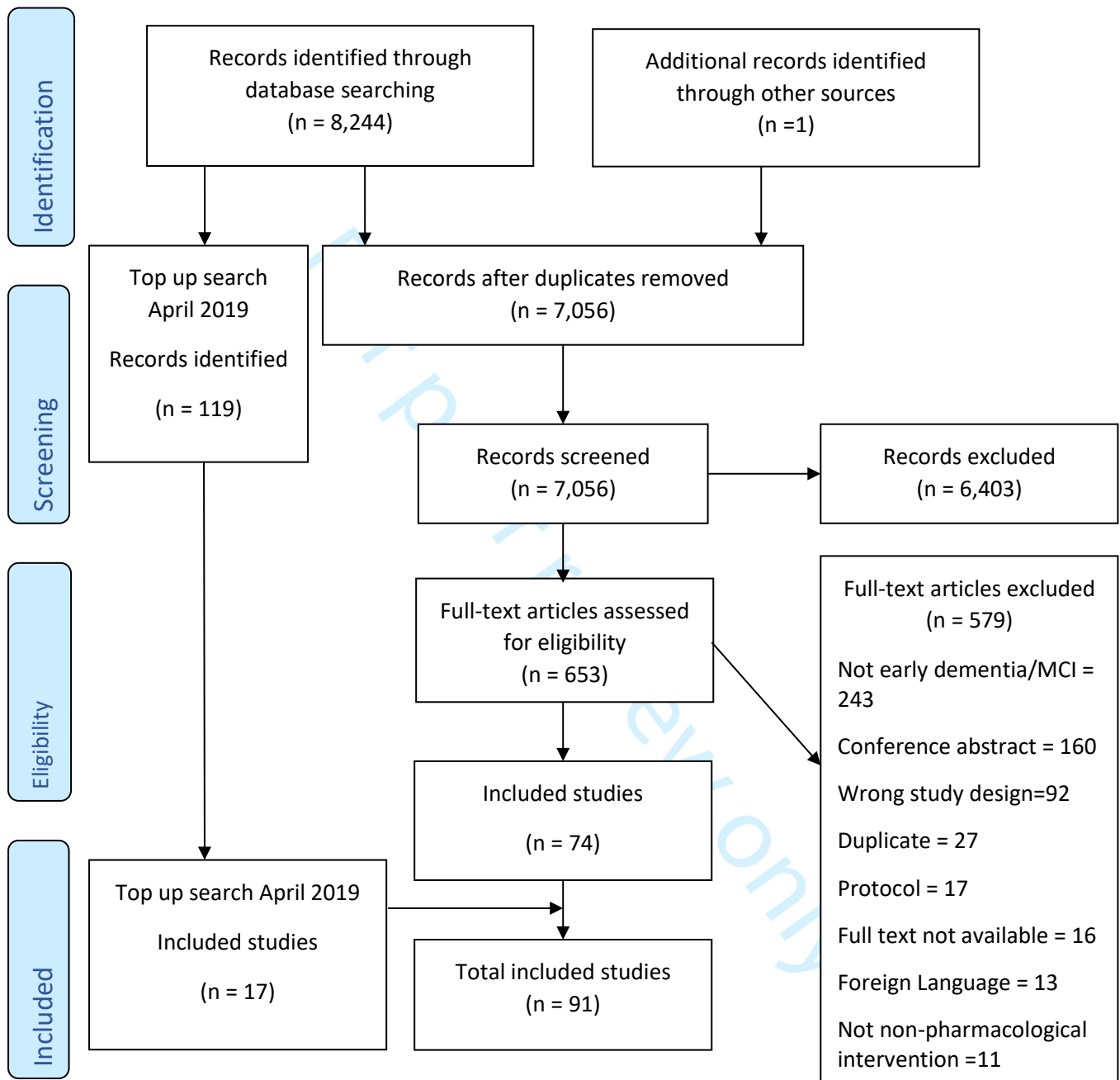
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5 Figure 1. Flow Chart of Included Studies  
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9 Figure 2. Trends in outcome measures over time

10 Note: QoL = quality of life; BPSD = behavioural and psychological symptoms of dementia  
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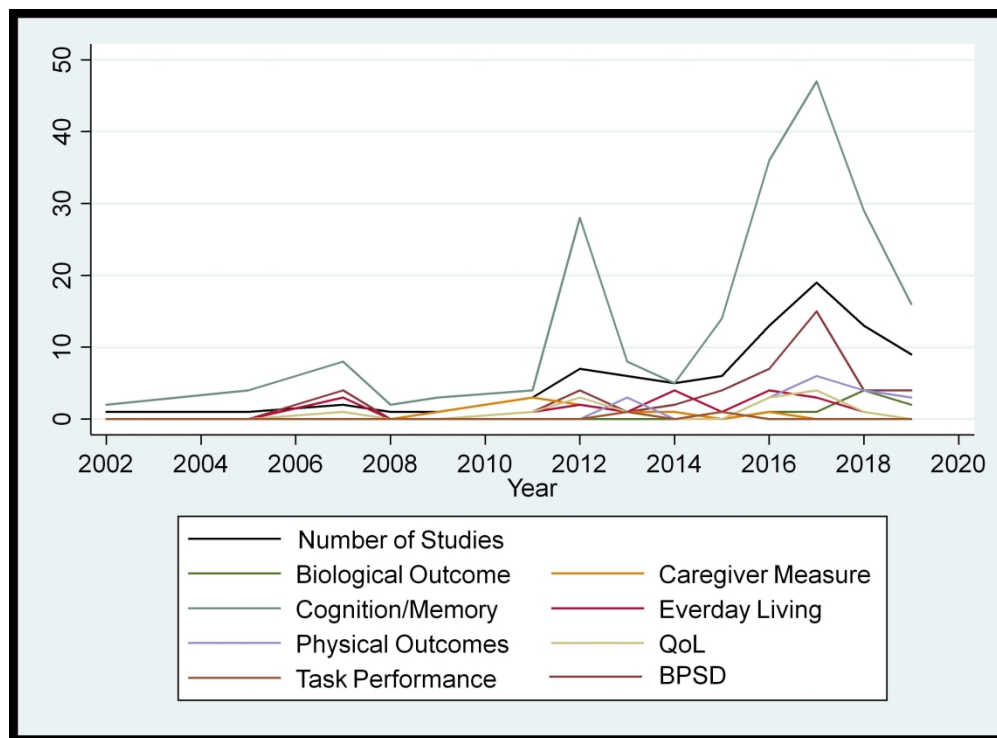


Figure 2. outcome measures over time

Note: QoL = quality of life; BPSD = behavioural and psychological symptoms of dementia.

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**Supplementary Table 1. Search Strategy for OVID**

	<b>Search term</b>		<b>Search term continued</b>
1	<b>1</b> Early dementia	<b>39</b>	self help group
2	<b>2</b> Mild dementia	<b>40</b>	psychotherapy
3	<b>3</b> mild alzheimer*	<b>41</b>	CBT
4	<b>4</b> early alzheimer*	<b>42</b>	Cognitive behavior?ral therap*
5	<b>5</b> cognitive impairment	<b>43</b>	Cognitive behavioural therap*
6	<b>6</b> age related cognitive impairment	<b>44</b>	Talking therap*
7	<b>7</b> Mild cognitive impairment	<b>45</b>	Individual therap*
8	<b>8</b> MCI	<b>46</b>	Peer support
9	<b>9</b> mild neurocognitive disorder	<b>47</b>	Counselling
10	<b>10</b> <b>1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9</b>	<b>48</b>	Communication
11	<b>11</b> cognitive training	<b>49</b>	acupuncture therap*
12	<b>12</b> brain training	<b>50</b>	acupuncture
13	<b>13</b> memory training	<b>51</b>	acupuncture points
14	<b>14</b> Behavior?r therap*	<b>52</b>	Transcranial Magnetic Stimulation
15	<b>15</b> Behavior?r modification	<b>53</b>	TMS
16	<b>16</b> pleasant activit*	<b>54</b>	Relaxation therap*
17	<b>17</b> Cognitive stimulation therapy	<b>55</b>	Therap* relaxation
18	<b>18</b> CST	<b>56</b>	Relaxation techniques
19	<b>19</b> Transcutaneous Electrical Nerve Stimulation	<b>57</b>	Early intervention
20	<b>20</b> TENS	<b>58</b>	Alternative therap*
21	<b>21</b> Exercise	<b>59</b>	<b>11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 19 OR 20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28 OR 29 OR 30 OR 31 OR 32 OR 33 OR 34 OR 35 OR 36 OR 37 OR 38 OR 39 OR 40 OR 41 OR 42 OR 43 OR 44 OR 45 OR 46 OR 47 OR 48 OR 49 OR 50 OR 51 OR 52 OR 53 OR 54 OR 55 OR 56 OR 57 OR 58 OR 59</b>
22	<b>22</b> exercise therap*	<b>60</b>	randomized controlled trial
23	<b>23</b> Walking	<b>61</b>	randomised controlled trial

<b>24</b>	music therap*	<b>62</b>	RCT
<b>15</b>	reminiscence therap*	<b>63</b>	Clinical Trial
<b>26</b>	massage therap*	<b>64</b>	intervention
<b>27</b>	therap* touch	<b>65</b>	<b>60 OR 61 OR 62 OR 63 OR 64 OR 65</b>
<b>28</b>	recreation therap*	<b>66</b>	early dementia
<b>29</b>	light therap*	<b>67</b>	mild dementia
<b>30</b>	therap* light	<b>68</b>	mild alzheimer*
<b>31</b>	sensory stimulation	<b>69</b>	early alzheimer*
<b>32</b>	multisensory stimulation	<b>70</b>	cognitive impairment
<b>33</b>	complementary therap*	<b>71</b>	age related cognitive impairment
<b>34</b>	aromatherapy	<b>72</b>	Mild cognitive impairment
<b>35</b>	support group	<b>73</b>	MCI
<b>36</b>	therap* group	<b>74</b>	mild neurocognitive disorder
<b>37</b>	memory group	<b>75</b>	<b>66 OR 67 OR 68 OR 69 OR 70 OR 71 OR 72 OR 73 OR 74 OR 75</b>
<b>38</b>	self help	<b>76</b>	<b>10 AND 59 AND 75</b>

## Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>TITLE</b>			
Title	1	Identify the report as a scoping review.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	2
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	5-6
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	6
<b>METHODS</b>			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	6
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	7-8
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	8
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Table 1
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	8-9
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	9
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	9
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	9



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>RESULTS</b>			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	9-10 and Figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	10 and Table 2
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Not feasible
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	10-13
<b>DISCUSSION</b>			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	13-14
Limitations	20	Discuss the limitations of the scoping review process.	16-17
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	17
<b>FUNDING</b>			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	18

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

\* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* ;169:467–473. doi: 10.7326/M18-0850



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