ABSTRACT

A SYSTEMATIC LITERATURE REVIEW OF COGNITIVE INTERVENTIONS FOR PEOPLE WITH DEMENTIA AND MILD COGNITIVE IMPAIRMENT

by Katherine M. Hubbard

The treatment of people with dementia has changed tremendously over the past few decades. Interventions for dementia vary from pharmacologic to cognitive to behavioral to environmental. The scope of this systematic literature review about cognitive interventions in people with dementia is limited to studies of randomized controlled trials (RCTs) for cognitive interventions. Four databases (Ageline, CINAHL, Psycinfo and PubMed) were used to locate the existing literature. Building upon previous reviews (Bahar-Fuchs et al., 2013; Kurz et al., 2011) this inquiry includes only those articles that were RCTs based upon cognitive interventions in people with dementia or mild cognitive impairment. Seventeen total articles were included for final review. Results suggest that the majority of interventions had positive results, but additional refinement of intervention strategies will bolster current results.
A SYSTEMATIC LITERATURE REVIEW OF COGNITIVE INTERVENTIONS FOR PEOPLE WITH DEMENTIA AND MILD COGNITIVE IMPAIRMENT

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INTRODUCTION

With a prevalence rate of 14.7% for those older than 70 in the United States, and a total monetary cost in 2010 between $157 billion and $215 billion, dementia represents a financial burden for society similar to that of cancer or heart disease (Hurd et al., 2013). For those with the disease, interventions are necessary that serve to slow the progression of the disease or improve quality of life.

The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) defines dementia as the development of multiple cognitive deficits where memory impairment and one or more of the following is present: aphasia (unable to comprehend language), apraxia (inability to execute motor planning), agnosia (loss of ability to comprehend the meaning of objects, people, sounds, or smells) or disturbance in executive functioning (regulation of cognitive functioning, reasoning, and problem solving), with significant impairment in social or occupational functioning (American Psychiatric Association, 2000).

The consequences of dementia do not end at monetary loss. The physical, mental, and emotional effects of dementia have a large impact on those with the disease and their loved ones. Dementia has an effect on cognition, functionality, and quality of life and may eventually lead to death. When measuring interventions and their ability to affect people with dementia, it is important to determine whether these consequences of dementia are being lessened or impacted by the interventions.

Pharmacological treatment is often where the field of medicine looks first for the treatment of disease, but that is not a very viable option for people with dementia (PWD). Thus far, symptomatic drugs have proven to be minimally effective (Birks & Flicker, 2006; Loy & Schneider, 2006; Chertkow et al., 2008) in the treatment of dementia. A recent systematic review of 64 trials testing various pharmacologic interventions (donepezil, galantamine, rivastigmine and memantine) for PWD, for example, found that magnitude of improvement was small and generally not clinically meaningful (Lin et al., 2013). Therefore, non-pharmacological treatment options are needed for PWD.

The recent literature places increased interest on the transitional stage between cognitive changes associated with normal aging and dementia, known as mild cognitive impairment (MCI). Individuals with MCI do not meet the clinical standards for
dementia, but experience the cognitive impairment that coincides with the disease. The presence of MCI increases the individual’s risk of developing dementia (Petersen et al., 2001). Since people with MCI have a higher risk of developing dementia, it’s important to study both MCI and dementia.

If MCI progresses to dementia, functional impairments tend to worsen as the disease progresses. An important factor that distinguishes MCI from dementia is the absence of significant deficits in activities of daily living (ADLs) in those with MCI (Yang et al., 2012). ADLs include things such as bathing, dressing, toileting, and eating.

**Cognitive Interventions**

Cognitive intervention targets cognitive functioning, rather than behavioral, emotional, or physical functioning (Bahar-Fuchs et al., 2013). The three cognitive interventions most commonly used are cognitive rehabilitation, cognitive training and cognitive stimulation.

Cognitive rehabilitation tends to focus on the identified needs of the individual by improving coping skills, and optimizing functioning and wellbeing. Outcome measures and goals are specifically tailored to the individual’s level of cognitive impairment, by focusing on the rehabilitation of cognition (Vidovich & Almeida, 2011). One such intervention combined strategies from psychotherapy (day structuring and activity planning) and neuro-rehabilitation with treatment carried out by experienced behavioral therapists (Kurz et al., 2012). However, while theoretically sound, the treatments were not proven effective.

A second type of cognitive intervention, cognitive training, is designed to enhance, or maintain a particular set of cognitive function and employs standardized, repeatedly performed tasks conducted through group sessions, individual sessions, or facilitated by family members (Bahar-Fuchs et al., 2011). An example of cognitive training is a computer based program built upon the principles of brain plasticity that involves seven exercises designed to improve processing speed and accuracy by employing repeatedly performed memory tasks (Barnes et al., 2009). The biggest criticism of cognitive training is the lack of focus on individual needs, and gains that are made tend to be task-specific (Vidovich & Almeida, 2011). An example of task-specific results includes one study of older adults that found those participants that underwent
speed of processing training and reasoning training (types of cognitive training) were involved in fewer ‘at fault’ car collisions over a period of 6 years when compared to the control group (Ball et al., 2010).

The third type of cognitive intervention is cognitive stimulation. Depending upon the target population, cognitive stimulation (CS) ranges from discussion and debate, problem solving, reminiscence therapy (discussion of past events and activities with other people through the use of tangible prompts, [Woods et al., 2005]) and validation therapy (based upon the acceptance of the reality and personal truth of another’s experience, with a person centered approach using factual words to build trust, [Neal & Wright, 2003]), and reality orientation (uses time, place, or person related orientation information to provide the person with a better understanding of their surroundings, Spector et al., 2000), and is most beneficial in groups., but the relationship between CS and its results are murky possibly due to a lack of grounding between the intervention and neuropsychological theories (Vidovich & Almeida, 2011).

Cognitive interventions’ success in the context of dementia varies across the three different types. Positive results from CS include improved cognitive performance and quality of life but the long term benefits of CS remain uncertain. Cognitive rehabilitation has encouraging results, but data from randomized controlled trials is lacking. The success of cognitive rehabilitation for PWD is influenced by practice, motivation, and program duration. Cognitive training can improve performance on trained tasks but evidence of transfer effects to other daily activities is limited (Vidovich & Almeida, 2011).

Seven previous reviews (Aguirre et al., 2012; Bahar-Fuchs, Clare, & Woods, 2013; Huckans et al., 2013; Kurz, Leucht, & Lautenschlager, 2011; Jean et al., 2010; Reijnders, van Heugten, & van Boxtel, 2012; Woods et al., 2012) were located that investigated cognitive interventions, or a type of cognitive intervention and how it affected people with dementia, or mild cognitive impairment. Table 1 below provides a brief summary of each review. Two of the previous reviews (Kurz, Leucht, & Lautenschlager, 2011; Bahar-Fuchs, Clare, & Woods, 2013) were chosen to build upon in this review because they had the most similar research question and methods to this
review and both only included randomized controlled trials. The following will provide further detail of both reviews.

Previous Reviews

This systematic review aims to build upon two previous reviews that focused on the significance of cognitive interventions tested through randomized controlled trials and had similar research questions to this review. Kurz et al. (2011) conducted a systematic

Table 1. Summary of Existing Reviews of Cognitive Interventions

<table>
<thead>
<tr>
<th>Author</th>
<th>Cognitive Intervention</th>
<th>Number of Articles Reviewed</th>
<th>Main Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aguirre et al., 2012</td>
<td>Cognitive stimulation (CS)</td>
<td>15</td>
<td>CS improves cognitive function, well being, quality of life, and communication in people with dementia</td>
</tr>
<tr>
<td>Bahar-Fuchs et al., 2013</td>
<td>Cognitive training (CT) and cognitive rehabilitation (CR)</td>
<td>11</td>
<td>Further well-designed studies are required to provide more definitive evidence for CT and CR</td>
</tr>
<tr>
<td>Huckans et al., 2013</td>
<td>Cognitive rehabilitation</td>
<td>14</td>
<td>CR can improve cognitive performance, but the results were inconsistent</td>
</tr>
<tr>
<td>Jean et al., 2010</td>
<td>Cognitive training, rehabilitation and stimulation</td>
<td>15</td>
<td>Recommendations for future studies included larger sample sizes, robust experimental design, and a standardized cognitive training manual</td>
</tr>
<tr>
<td>Kurz et al., 2011</td>
<td>Cognitive training, rehabilitation and stimulation</td>
<td>33</td>
<td>The potential of cognitive interventions have been obscured by methodological inconsistencies, further RCTs are required using consistent methods</td>
</tr>
<tr>
<td>Reijnders et al., 2013</td>
<td>Cognitive training, rehabilitation and stimulation</td>
<td>35</td>
<td>Cognitive training can be effective in improving cognitive functioning, but it is unclear whether it generalizes to everyday life activities</td>
</tr>
<tr>
<td>Woods et al., 2012</td>
<td>Cognitive stimulation (CS)</td>
<td>15</td>
<td>CS benefits cognition in PWD, but the studies were of variable quality, further research is necessary of longer term CS programs</td>
</tr>
</tbody>
</table>
review on the clinical significance of cognition focused interventions by collecting information from recent reviews and meta-analyses, along with searching electronic databases (Medline, Science Citation Index Expanded). The research question that guided the review investigated whether cognitive interventions tested through RCTs provide clinically meaningful benefits to cognitively impaired older adults. Clinically meaningful benefits were defined as those treatments that delayed symptom progression and showed evidence of statistically significant treatment differences. Cognitive training, cognitive stimulation, and cognitive rehabilitation were the three classifications used to define the cognitive interventions reviewed. The timeframe of articles included in the review were from 1982 to 2010. The conclusion reached was with very few exceptions, studies with convincing evidence of clinical significance were scarce in terms of delay of cognitive decline, enhanced attainment of personally relevant goals, or improvement in activities of daily living.

Bahar-Fuchs et al. (2013) conducted a systematic review of cognitive training and cognitive rehabilitation interventions for people with mild to moderate dementia. The research question that guided the review was to investigate the evidence regarding the effects of cognitive training and cognitive rehabilitation for people with mild to moderate dementia tested through RCTs. The database used was the Cochrane Dementia and Cognitive Impairment Group’s Specialized Register. The articles included were from 1988 to 2010. The discussion section of the review investigated issues related to the lack of randomized controlled trials testing cognitive interventions, along with the lack of studies testing cognitive interventions. The conclusions were that many studies have recently been focused on early cognitive impairment and the prevention of dementia through cognitive intervention, and that cognitive intervention studies are often mislabeled, leading to confusion about the definition of cognitive intervention. The conclusion was that no positive or adverse effects were found for cognitive training. This is a finding in itself because a previous study found that cognitive training may have a negative impact on mood (Small et al., 1997).

Given what is known about dementia and cognitive interventions from previous reviews, and the issues facing those with the disease, the area of greatest inquiry is on
empirically tested cognitive interventions and how they compare. This systematic literature review will evaluate existing cognitive interventions tested through randomized controlled trials to determine which type is most effective for people with dementia or mild cognitive impairment in terms of outcomes measured. Before moving forward, a brief explanation of randomized controlled trials is provided to explain their importance.

**Randomized Controlled Trials**

The most rigorous way of determining if a cause-effect relationship exists between two measures is through the use of randomized controlled trials (RCTs). There are several reasons for this. Participants are randomly allocated to an intervention group or a control group (Sibbald, 1998). This random allocation helps to reduce the risk of a spurious relationship caused by confounding variables (those variables that seem to have a cause and effect relationship but are not actually related). Any significant differences seen from the intervention between groups can be linked to the intervention rather than some unidentified factor (Stolberg, Norman, & Trop, 2004). Protocols often dictate that participants and researchers should be blind to which treatment is given until the study is complete, although this is not always feasible (Sibbald, 1998). Blinding, for example, would be impossible in a study where the researcher must have knowledge of group assignment in order to administer the proper treatment, be it the intervention treatment or the placebo. This particular type of study design allows the researcher a reduction in the risk of a serious imbalance among research participants’ characteristics because there is an equal chance of being assigned to any group. No other study design allows researchers this power. Due to this, RCTs are seen as the ‘gold standard’ for determining causation (Stolberg, Norman, & Trop, 2004).

**Rationale**

Despite the previous reviews with similar research questions, this review uses different databases. As opposed to specifically medical or scientific audiences, the databases used in this review are targeted toward many different audiences. Rather than create an exact duplicate of the previous reviews, different databases were used.

**Method**

This essential research question has guided this systematic review on the efficacy of cognitive interventions among those who have dementia or mild cognitive impairment:
• Do any cognitive interventions (cognitive training, cognitive rehabilitation, or cognitive stimulation) tested through randomized controlled trials have significant results for older people with dementia or mild cognitive impairment in terms of outcomes measured?

**Systematic Literature Reviews**

A systematic literature review is based upon a clearly formulated question that guides the identification of relevant studies in literature databases, and then appraises their quality and summarizes the evidence with explicit methodology. This systematic and explicit approach is what distinguishes a systematic literature review from traditional reviews (Khan, Kunz, and Antes, 2003). The quality of rigor for this review was supported by only including peer-reviewed manuscripts published in scholarly journals.

**Search Terms**

Four databases were searched including Ageline, CINAHL, PsycInfo, and PubMed. The six search terms used for all four databases were: Cognitive impairment OR dementia, cognitive rehabilitation OR cognitive training OR cognitive stimulation, and randomized controlled trial. Ageline, CINAHL, and PsycInfo were part of the same database search engine of EbscoHost and were, therefore, searched together with the aforementioned search terms and PubMed was searched separately. Due to the medical nature of PubMed, more search terms were necessary to narrow down the 700 results to exclude articles that focused on participants with stroke, cancer, traumatic brain injury, Parkinson’s disease or schizophrenia. These searches are broken down in Tables 1 and 2 and will be further explained in the results section.

**Inclusion Criteria**

To ensure the rigor and validity of this review, only certain articles were included. Only published, peer-reviewed articles were included to guarantee their quality. The articles had to be based on randomized controlled trials testing one of the three cognitive interventions defined earlier (cognitive training, cognitive stimulation or cognitive rehabilitation). Participants needed to have dementia or mild cognitive impairment (MCI) because the research question includes this population. In order to exclude as few articles as possible, the age cut-off specified in the searches was 55 years old.

**Exclusion Criteria**
All non-English articles were excluded, along with duplicate articles between the four databases. Systematic reviews and meta-analyses were excluded from the final review because they are secondary sources analyzing primary sources, which is beyond the scope of this review. Articles that did not present research that tested cognitive interventions were excluded. Dissertations were excluded because they were not peer-reviewed manuscripts in scholarly journals. Study protocols were also excluded because they yield no results to compare. All studies had to include participants with mild cognitive impairment (MCI), or dementia. Those with strictly non-impaired participants in the intervention group were not included. This exclusion was made to coincide with the research question: Do any cognitive interventions (cognitive training, cognitive rehabilitation, or cognitive stimulation) tested through randomized controlled trial have significant results for older people with dementia or mild cognitive impairment in terms of outcomes measured?

There were no exclusion criteria based on the year the article was published, as long as the article met the criteria. The articles included for review ranged from published dates 1995 to 2014. The articles were accessed in May of 2014.

RESULTS

Two separate searches were conducted among the chosen databases. Ageline, CINAHL, and PsycInfo were accessible through a common search engine and, therefore, the search terms were entered and articles retrieved through one combined search. Duplicates were removed prior to analysis. The second search, using the same search terms, was conducted within PubMed.

Table 2 illustrates the number of articles returned after a thorough search of Ageline, CINAHL and PsycInfo. Fewer search steps were necessary for these databases because of the psychological and sociological nature of the databases.

<table>
<thead>
<tr>
<th>Search Terms</th>
<th>Articles Returned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive impairment OR dementia</td>
<td>127,807</td>
</tr>
<tr>
<td>Cognitive training OR cognitive rehabilitation OR cognitive stimulation</td>
<td>1,778</td>
</tr>
<tr>
<td>Randomized controlled trials</td>
<td>127</td>
</tr>
<tr>
<td>Peer reviewed</td>
<td>85</td>
</tr>
</tbody>
</table>
Table 3 illustrates the number of articles returned after a thorough PubMed search. PubMed was part of a different database search engine than the other three databases and therefore has its own table to illustrate the articles returned. The ‘NOT’ row was included in the search terms in order to exclude articles that focused on study participants with stroke, cancer, Parkinson’s disease, schizophrenia, depression, or traumatic brain injury, as well as articles that focused on exercise, pharmacology, animals, surgical techniques or psychotherapy. These terms were excluded because they are beyond the scope of this review about cognitive impairment and dementia. Title and abstract searches were employed. Since PubMed does not have the option to search only peer-reviewed journals, it was done by hand when going through the 196 articles to ensure the articles that met the inclusion criteria were in journals that were peer reviewed.

Table 3. Database Search- PubMed

<table>
<thead>
<tr>
<th>Search Terms</th>
<th>Articles Returned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive impairment OR dementia</td>
<td>176,845</td>
</tr>
<tr>
<td>Cognitive training OR cognitive rehabilitation OR cognitive stimulation</td>
<td>13,953</td>
</tr>
<tr>
<td>Randomized Controlled Trial</td>
<td>986</td>
</tr>
<tr>
<td>NOT exercise, stroke, cancer, pharmacology, pharmacological, Parkinson’s, schizophrenia, depression, psychotherapy, animal, surgical, traumatic brain injury</td>
<td>245</td>
</tr>
<tr>
<td>English</td>
<td>234</td>
</tr>
<tr>
<td>NOT meta-analysis, systematic review</td>
<td>214</td>
</tr>
<tr>
<td>NOT protocol or dissertation</td>
<td>196</td>
</tr>
</tbody>
</table>

Selection of Articles to Review

There were 281 (196 from PubMed, and 85 from Ageline, CINAHL, PsycInfo; see Tables 2 and 3) total articles located through the four database searches. Of those 281 articles, 17 met the inclusion criteria. In order to be included, the 17 articles were all randomized controlled trials, testing one of the three cognitive interventions (cognitive stimulation, cognitive rehabilitation or cognitive training) with mild cognitive impairment or dementia participants. The articles also had to be published and peer reviewed to ensure their quality. PubMed did not have an option to exclude articles that had not been
peer reviewed so the articles that met the inclusion criteria were investigated to make sure the journals that published them were peer reviewed.

Figure 1 below illustrates how the 281 articles were systematically narrowed down to 17. The flow chart combines the results of the four database searches and illustrates why each article was excluded and how the final number of articles for review came to seventeen.

**Description of Included Studies**

Seventeen articles met the inclusion criteria to be included in this review. Table 4 summarizes all 17 studies across various dimensions including age of participants, type of intervention, outcomes measured, and whether the study had significant findings (meaning the intervention had an effect on the outcome measure). Of the 17 studies, three (Greenaway, Duncan & Smith, 2012; Tappen & Hain, 2013; Barnes et al., 2009) were conducted in the United States and the rest were conducted in various countries across the world including Germany (Kurz et al., 2012; Luttenberger et al., 2012), Wales (Clare et al., 2010), England (Woods et al., 2006), Italy (Mapelli et al., 2013), Spain (Gaitan et al., 2013; Tarraga et al., 2006), Brazil (Rozenfeld-Olchik et al., 2013), Australia (Vidovich et al., 2014) Japan (Yamanaka et al., 2013) and Portugal (Alves et al., 2014).

There were eight cognitive stimulation studies, six cognitive training studies, and three cognitive rehabilitation studies. The average number of participants was 96. The majority of studies had participants with dementia, while the rest had participants with mild cognitive impairment.
Figure 1 - Article Exclusion

281 Articles from Ageline, CINAHL, PsycInfo, and PubMed met search criteria

- 150 studies were not cognitive interventions
- 74 studies did not have participants with cognitive impairment
- 15 articles were systematic reviews
- 9 articles were duplicates
- 6 articles were non-randomized controlled trials
- 6 articles were protocols or dissertations and did not yield results and were therefore excluded
- 2 had participants under 50 years old
- 2 were non-English

17 studies met selection criteria
Diversity of Included Studies

The length of interventions varied considerably among the included studies ranging from 5 weeks to 24 weeks. The most common outcomes measured were cognitive performance (13 articles), functional performance (6 articles), quality of life (4 articles), and neuropsychological performance (1 article), but a wide variety of measures were used to evaluate each outcome. For example, among the cognitive stimulation group of articles, six measures were used for cognitive performance: the Clinical Dementia Rating Scale (Morris, 1993), the Alzheimer’s Disease Assessment Scale-Cognitive (Rosen et al., 1984), the Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975), the Mattis Dementia Rating Scale (Mattis, 1976), the Global Deterioration Scale (Reisberg et al., 1982), and the Nurses’ Observation Scale for Geriatric Patients (Spiegel et al., 1991). Also, among the interventions that measured functional outcomes, several different measures were employed including the Barthel Index (Mahoney & Barthel, 1965), the Instrumental Activities of Daily Living measure (Lawton & Brody, 1969), the Direct Assessment of Functional Status (Loewenstein, et al., 1989), and the Bayer Activities of Daily Living (Hindmarch et al., 1998). Due to this, comparison across the different studies among outcomes is made more difficult because the measures are not equal.

The administration of the cognitive interventions differed across the seventeen studies. For the cognitive training interventions, three programs were conducted on a computer, two were conducted in a group setting, and one was done individually at home. All three of the cognitive rehabilitation interventions were done individually outside the home by professionals trained to administer the treatment. Of the eight cognitive stimulation interventions, seven were conducted in a group setting while one was conducted online.

Sample size varied across all 17 studies. It did not seem to have any effect on whether the findings were significant, as there is a wide diversity of sample sizes in those studies with significant findings. Also, those with small or large sample sizes do not show a trend toward significant or insignificant findings.
## Table 4. Summary of Studies Included for Review

<table>
<thead>
<tr>
<th>Authors</th>
<th>N</th>
<th>Level of Impairment</th>
<th>Mean Age (SD)</th>
<th>Type of Cognitive Intervention</th>
<th>Intervention Group</th>
<th>Control Group</th>
<th>Primary Outcomes Measured</th>
<th>Significant Findings?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenaway et al. (2012)</td>
<td>40</td>
<td>Mild cognitive impairment (MCI)</td>
<td>Interven-72.7 (6.9) Control-72.3 (7.9)</td>
<td>Cognitive rehabilitation</td>
<td>Received training for the memory support system, 12, 1-hour training sessions over 6 weeks</td>
<td>Received no training on the memory support system</td>
<td>Functional and cognitive performance, quality of life measures</td>
<td>Yes</td>
</tr>
<tr>
<td>Kurz et al. (2012)</td>
<td>201</td>
<td>Dementia</td>
<td>Interven-72.4 Control-75.0</td>
<td>Cognitive rehabilitation</td>
<td>12 weekly 1 hour sessions with use of memory aids, day structuring</td>
<td>Standard care</td>
<td>Functional performance</td>
<td>No</td>
</tr>
<tr>
<td>Clare et al. (2010)</td>
<td>69</td>
<td>Alzheimer’s Disease (AD)</td>
<td>77.8 (6.32)</td>
<td>Cognitive rehabilitation</td>
<td>8 weekly sessions addressing aids and strategies, techniques for learning new info &amp; stress management</td>
<td>Placebo condition and a no treatment control condition</td>
<td>Functional performance (Attainment of personally set goals using the Canadian Occupational Performance Measure)</td>
<td>Yes</td>
</tr>
<tr>
<td>Rozenfeld Olchik et al. (2013)</td>
<td>112</td>
<td>MCI</td>
<td>68.7</td>
<td>Cognitive training</td>
<td>Explanatory class on memory and aging; memorization strategies and exercises for 8 wks</td>
<td>No treatment</td>
<td>Cognitive outcomes from the intervention</td>
<td>Yes</td>
</tr>
<tr>
<td>Tappen and Hain, (2013)</td>
<td>68</td>
<td>MCI, or early-stage Alzheimer’s</td>
<td>81.4</td>
<td>Cognitive training</td>
<td>Functionally oriented 12 wk in-home training prgm. using spaced retrieval, face name assoc. etc.</td>
<td>Effort and attention control group of life story interviews</td>
<td>Functional performance, and cognitive performance</td>
<td>No</td>
</tr>
<tr>
<td>Authors</td>
<td>N</td>
<td>Diagnosis</td>
<td>Mean Age (SD)</td>
<td>Type of Cognitive Intervention</td>
<td>Intervention Group</td>
<td>Control Group</td>
<td>Primary Outcomes Measured</td>
<td>Significant Findings?</td>
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<tr>
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<tr>
<td>Barnes et al. (2009)</td>
<td>47</td>
<td>Mild cognitive impairment (MCI)</td>
<td>74 (Not reported)</td>
<td>Cognitive training</td>
<td>Exercises to improve auditory processing speed and accuracy for 100 minutes/day, 5 days/week for 6 weeks</td>
<td>Non-educational computer based activities</td>
<td>Neuropsych. outcomes and cognitive outcomes</td>
<td>No</td>
</tr>
<tr>
<td>Gaitan et al., (2012)</td>
<td>60</td>
<td>MCI and Alzheimer’s disease</td>
<td>75.8 (5.46)</td>
<td>Cognitive training</td>
<td>Computer based cognitive training for 12 weeks to improve and maintain, attention, concentration, perception, and language</td>
<td>Traditional pen and paper cognitive training</td>
<td>Cognitive outcomes</td>
<td>No</td>
</tr>
<tr>
<td>Zhuang et al. (2013)</td>
<td>33</td>
<td>MCI and dementia</td>
<td>Not reported</td>
<td>Cognitive training</td>
<td>Human-computer interaction based comprehensive training for 24 weeks</td>
<td>No treatment</td>
<td>Cognitive performance</td>
<td>No</td>
</tr>
<tr>
<td>Vidovich et al. (in press)</td>
<td>160</td>
<td>MCI</td>
<td>75 (5.8)</td>
<td>Cognitive training</td>
<td>10, 90 min. sessions for 5 weeks. Education on changes in cognition, use of memory strategies to enhance cognition</td>
<td>Non-specific educational program</td>
<td>Cognitive performance</td>
<td>No</td>
</tr>
<tr>
<td>Alves et al. (2014)</td>
<td>20</td>
<td>Cognitive impairment</td>
<td>Interv-79.9(9.0) control-77.7(12.4)</td>
<td>Cognitive stimulation (CS)</td>
<td>Either standard CS (17 sessions, 6 weeks) or brief CS (11 sessions, 4 weeks) focused on stimulating memory, verbal skills, attention, reasoning, etc.</td>
<td>Wait-list</td>
<td>Cognitive and functional performance</td>
<td>No</td>
</tr>
<tr>
<td>Luttenberger et al. (2012)</td>
<td>139</td>
<td>Dementia</td>
<td>84.7 (4.9)</td>
<td>Cognitive stimulation</td>
<td>6 mo. intervention of motor stimulation, activities of daily living and CS Program</td>
<td>Treatment as usual</td>
<td>Functional performance, overall dementia symptoms</td>
<td>Yes</td>
</tr>
<tr>
<td>Author</td>
<td>N</td>
<td>Diagnosis</td>
<td>Mean Age (SD)</td>
<td>Type of Cognitive Intervention</td>
<td>Intervention Group</td>
<td>Control Group</td>
<td>Primary Outcomes Measured</td>
<td>Significant Findings</td>
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<tr>
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</tr>
<tr>
<td>Yamanaka et al. (2012)</td>
<td>56</td>
<td>Dementia</td>
<td>83.9 (5.9)</td>
<td>Cognitive stimulation</td>
<td>14 sessions twice a week for 7 weeks of word and number games, word associations, etc.</td>
<td>No treatment</td>
<td>Cognitive performance, quality of life and mood</td>
<td>Yes</td>
</tr>
<tr>
<td>Aguirre et al. (2012)</td>
<td>272</td>
<td>Dementia</td>
<td>82.6 (8.1)</td>
<td>Cognitive stimulation</td>
<td>14, 45 min-sessions over 7 weeks in a group setting of cognitive stimulation</td>
<td>No treatment</td>
<td>Cognitive performance, quality of life</td>
<td>Yes</td>
</tr>
<tr>
<td>Tarraga et al. (2006)</td>
<td>46</td>
<td>Alzheimer’s disease</td>
<td>76.7</td>
<td>Cognitive stimulation</td>
<td>Multimedia internet based system for cognitive stimulation and an integrated psycho-stimulation program for 12 weeks</td>
<td>Received usual treatment</td>
<td>Cognitive performance</td>
<td>Yes</td>
</tr>
<tr>
<td>Mapelli et al. (2013)</td>
<td>30</td>
<td>Dementia</td>
<td>83.9</td>
<td>Cognitive stimulation</td>
<td>8 weeks of spatial, personal, and temporal orientation sessions and individual exercises for 5 areas (language, memory, spatial and temporal orientation, attention and logic)</td>
<td>Continued with usual activities</td>
<td>Cognitive performance</td>
<td>Yes</td>
</tr>
<tr>
<td>Woods et al. (2006)</td>
<td>201</td>
<td>Dementia</td>
<td>85.3 (7)</td>
<td>Cognitive stimulation</td>
<td>14 sessions, twice weekly for 7 weeks. Program entailed reality orientation, reminiscence therapy, etc.</td>
<td>Usual treatment</td>
<td>Quality of life</td>
<td>Yes</td>
</tr>
<tr>
<td>Quayhagen et al. (1995)</td>
<td>78</td>
<td>Dementia</td>
<td>73.6 (8.0)</td>
<td>Cognitive stimulation</td>
<td>60 mins/day, 6 days/week, for 12 weeks, memory, problem solving and conversation activities</td>
<td>Wait-list</td>
<td>Cognitive performance</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Analysis and Critique of the Measures Used

There were multiple measures used in the previous seventeen articles included in this systematic review. To illustrate, cognitive outcomes were the most common measured, and the Mini-Mental State Examination (MMSE) was the most often used to measure cognition, followed by the Clinical Dementia Rating Scale. The MMSE (Folstein, Folstein, & McHugh, 1975) has excellent reliability and validity as a clinical screening tool that assesses the cognitive state of elderly patients, and is often seen as the gold standard in research articles because it is so widely used. A major bias found in the MMSE has to do with level of education and its effect on scores; specifically those with lower education tend to have lower specificity and sensitivity of scores than those with higher education (McDowell, 2006). This is an important bias to mention because education is not always a demographic characteristic that is collected during a study. The MMSE may be considered the gold standard, but its bias tends to slightly reduce its validity. A major benefit of only including randomized controlled trials is that this bias is spread out randomly across all participants in both the control group and the intervention group.

The Clinical Dementia Rating Scale (CDR) was developed in 1979 at the Memory and Aging Project at Washington University School of Medicine in order to evaluate the stages of severity in dementia. The CDR scale ranges from CDR-0 which indicates a lack of dementia, to CDR-3 which indicates severe dementia. The global CDR scale rating is derived from six domains: memory, orientation, judgment and problem solving, community affairs, home and hobbies, and personal care (Morris, 2001). Inter-rater reliability is adequate on the scale and it has been found to be reliable for both clinicians and physicians (McCulla, 1989). The downside to the CDR scale is that it uses both knowledgeable informants and the subject to measure dementia, and if either is lacking accuracy, the scale is not accurate and therefore compromised (Morris, 2001). In people with dementia and mild cognitive impairment, inaccuracies in self-reporting may occur, which has the ability to affect the CDR scale.

Efficacy of Cognitive Interventions

Cognitive Rehabilitation
Among the three cognitive rehabilitation studies, functional performance was measured across all three, but only two had significant findings. All three studies had different levels of cognitive impairment among their participants, which is common among cognitive interventions tested through randomized controlled trials as can be seen in Table 4. The study that did not have significant findings (Kurz et al., 2012) used memory aids for 12 weekly, one hour sessions, with a functional outcome measure. The insignificant findings are surprising with the large sample size (n=201) in the study conducted by Kurz et al. (2012) compared to the other two studies, (n=69, n=40 respectively).

The two studies with significant findings improved goal performance and satisfaction (Clare et al., 2010) along with activities of daily living and sense of memory self-efficacy (Greenaway et al., 2012). Both used different measures to test functional outcomes; Clare et al. (2010) used the Canadian Occupational Performance Measure (Law et al., 1994) and Greenaway et al. (2012) used the Everyday Cognition Scale (Tomaszewski-Farias et al., 2011) to measure activities of daily living. Both studies had significant results, but with different measures, comparison among the two measures is not feasible.

Across the three different studies, each used different measures for cognition. Greenaway et al. (2013) used three measures alone to measure cognition: the Everyday Cognition (ECog) (Tomaszewski-Farias et al., 2011) the Mini-Mental State Examination (MMSE), and the Mattis Dementia Rating Scale (DRS) (Mattis, 1976). This is a trend among cognitive interventions; multiple measures used across studies to measure the same thing, be it functional ability, cognition, or quality of life. All three cognitive rehabilitation interventions were administered individually to participants.

Cognitive Training

Across the cognitive training studies, one of the six had significant findings. The study with significant findings had participants with mild cognitive impairment. There were five cognitive outcomes, two neuropsychological outcomes, and one functional outcome.

The six different cognitive training studies used different cognition measures, including the Repeatable Battery for Assessment of Cognitive Status (Randolph et al.,
1998), the MMSE, Clinical Dementia Rating (CDR) (Hughes et al., 1982), and the Cambridge Cognitive Examination-Revised (Roth, Mountjoy, & Tym, 1998). Three interventions were conducted in groups, two interventions were administered at participants’ homes, and one was conducted in a nursing home. The study with significant findings (Rozenfeld Olchik et al., 2012) conducted their intervention in groups and found that participants with mild cognitive impairment in the intervention group exhibited cognitive performance typical of individuals without cognitive impairment.

**Cognitive Stimulation**

Seven of the eight cognitive stimulation interventions had significant findings. Seven of the eight had participants with some form of dementia, and the eighth had participants with cognitive impairment. Six interventions measured cognitive performance, two measured functional performance, and three measured quality of life. The intervention activities ranged from reminiscence therapy, to reality orientation, to word association and number games.

Of the seven interventions with significant findings, all had participants with a form of dementia, which may have contributed to the lack of significant findings for the eighth intervention in which participants had cognitive impairment. Improvements were made in participants’ quality of life (Yamanaka et al., 2013; Woods et al., 2006; Aguirre et al., 2012), cognition (Quayhagen et al., 1995; Tarraga et al., 2006; Mapelli et al., 2013; Aguirre et al., 2012), instrumental activities of daily living (Luttenberger et al., 2012), and behavior symptoms (Mapelli et al., 2013; Luttenberger et al., 2012).

Among those cognitive stimulation interventions that measured quality of life, all three used the Quality of Life-Alzheimer’s Disease measure (Logsdon et al., 2002). For functional performance, the Instrumental Activities of Daily Living measure and the Barthel Index measure were employed. Seven of the eight interventions were conducted in groups, while the eighth intervention was conducted on a computer at home.

**Efficacy of Intervention Based upon Outcomes**

**Cognitive Outcomes**

Thirteen of the seventeen interventions measured cognition, using multiple measures such as the MMSE or the Clinical Dementia Rating. Six of the thirteen did not have significant findings, and of those six without significant findings, five were
cognitive training interventions, and one was a cognitive stimulation intervention. Of those seven interventions that had positive findings, participants in the intervention group improved their cognitive performance when comparing pre- and post-test results.

There was a pattern in terms of the level of cognitive impairment for participants when comparing those interventions with and without significant findings. All six of the studies with insignificant findings had participants with MCI, while the majority (five of seven) of the studies with significant findings had participants with dementia.

**Functional Outcomes**

Six of the seventeen interventions measured functional outcomes, with the majority focused on activities of daily living. Three of the six interventions had significant findings. Of the three without significant findings, two were cognitive rehabilitation interventions and one was a cognitive stimulation intervention. All three interventions with significant findings found that the experimental groups had significant improvements on functional outcomes compared to the control groups. Those interventions with significant findings varied in terms of level of cognitive impairment, with no apparent pattern coinciding with whether or not the intervention was significant. For those three interventions with significant findings, two had participants with a form of dementia and one had participants with MCI. For those three interventions without significant findings, one had participants with MCI, one had participants with a form of dementia, and one had participants with MCI and/or dementia.

**Quality of Life Outcomes**

Four of the seventeen interventions measured quality of life outcomes. All four had significant findings. Three of the four were cognitive stimulation interventions and all four used the same measure of quality of life (Quality of Life-Alzheimer’s Disease, Logsdon et al., 2002). The Quality of Life-AD is a 13 item measure that has been used for people with MCI to rate relationships, physical condition, mood, energy level, memory, aspects of daily functioning, and concerns about finances (Logsdon et al., 2002). In terms of reliability and validity, the content and construct validity are good, along with the inter-rater reliability, and internal consistency was excellent with a Cronbach’s alpha coefficient of .82 (Thorgrimsen et al., 2003). The interventions
measuring quality of life outcomes were the only studies that used the same measure across the interventions, and all studies had significant, positive findings.

**DISCUSSION**

The aim of this systematic review was to investigate the three types of cognitive interventions for people with dementia and build upon previous reviews (Bahar-Fuchs et al., 2013; Kurz et al., 2011). Seventeen studies of cognitive interventions were located that fit the inclusion criteria and were included in this review. All of the interventions had participants with mild cognitive impairment or a form of dementia, using randomized controlled trials to test each intervention. No adverse effects were reported among all 17 articles and ten had significant findings. Of those ten, two were cognitive rehabilitation interventions, one was a cognitive training intervention, and seven were cognitive stimulation interventions. The diversity of measures used across functional and cognitive outcomes made firm conclusions difficult.

The results suggest that cognitive stimulation may be the best intervention for people with dementia or mild cognitive impairment, as they are specifically targeted at enhancing the cognitive functioning of the individual. Seven of the eight studies testing cognitive stimulation (which aims at personalized enhancement of cognitive function) had consistently positive and significant findings. All but one of these interventions improved either cognitive outcomes, quality of life outcomes, or functional outcomes. Also, administration of the interventions is conducted in groups, which may have an additional positive effect because of the interaction with others. These results are supportive of findings within a previous review (Kurz et al., 2011) in that cognitive stimulation shows the most promise for non-pharmacological interventions.

In terms of outcomes measured, quality of life outcomes consistently reported positive and significant findings across the three types of cognitive interventions tested. Also, the same measure was used across all studies that measured quality of life (Quality of Life- Alzheimer’s Disease, Logsdon et al., 2002), which may have led to the consistent positive results since many of the other outcomes used different measures. Across all seventeen studies, cognitive stimulation interventions measuring quality of life outcomes were consistently positive and had significant findings. This suggests that the combination of cognitive stimulation interventions with quality of life outcomes is the
best combination for a successful randomized controlled trial testing a cognitive intervention for older adults with dementia or mild cognitive impairment. It is worth mentioning that cognitive rehabilitation interventions had 2 of three with significant findings. This may be caused by the general lack of cognitive rehabilitation interventions

**Comparisons of Previous Reviews—Critiques, and Similarities**

**Summary of Earlier Systematic Reviews**

The primary findings from the Kurz et al. (2011) review were that cognition focused interventions have very little impact on older adults with cognitive impairment in terms of their ability to manage real-life challenges (ability to manage activities of daily living, and instrumental activities of daily living, such as balancing a checkbook or cooking and cleaning), but that cognitive stimulation shows the most promise. Thirty three studies were included in their review and there were only four duplicates between that review and this review. The criteria for inclusion were much like this review in that only randomized controlled trials of participants with an MCI or dementia diagnosis in a peer reviewed journal were included, and only if that intervention focused on cognition. The databases differed from this review in that Medline and Science Citation Index Expanded were searched.

The primary findings from the Bahar-Fuchs et al. (2013) review were that no positive or adverse effects were found for cognitive training. Eleven studies were included in the final review from 1988 until 2010, and the inclusion criteria were similar to this review as well: Only randomized controlled trials, published in English, comparing cognitive rehabilitation or cognitive training interventions for people with dementia were included. Two of the eleven studies included were also included in this review. The largest difference lies in the databases used; Bahar-Fuchs et al. (2013) used the Cochrane Dementia and Cognitive Impairment Group’s Specialized Register, while this review used Ageline, CINAHL, PsycInfo and PubMed.

**Similarities among Previous Reviews**

Kurz et al. (2011) found that cognitive stimulation interventions showed the most promise among cognitive interventions, which was supported by this review. As seen in Table 4, cognitive stimulation interventions had the most significant results across all three types of interventions. In respect to the number of measures used across all 17
studies, this review supports the findings of Kurz et al. (2011) in that heterogeneity of methods and measures across studies was evident. These inconsistencies made it especially difficult to provide firm conclusions for cognitive outcomes and functional outcomes. These results also coincide with Bahar-Fuchs et al. (2013) in that the number of outcomes measured across studies created constraints in the comparisons across studies. As mentioned before in this review, the number of measures used for cognitive and functional outcomes were particularly large, as illustrated previously.

**Critique of Previous Reviews**

A critique of the previous two reviews involves the limited databases that were employed to find articles for systematic review. The databases used for this review cover a wide variety of fields by including psychological literature, medical literature, nursing literature, and gerontological or aging literature. By using only the Cochrane Dementia Register Database, or Medline and Science Citation Database, as the previous two reviews used, a more narrow scope was placed upon what was included for review.

**What is Unique to this Review?**

By including four different databases from four different fields for this review, the scope is expanded to medical, psychological, nursing, and gerontological literature. This is important because different perspectives and schools of thought help to contribute to this review and the articles included. The previous reviews were limited by the lack of variety in their database searches.

Although there are some similar conclusions present across the previous two reviews and this one, the most important conclusion for this review is that despite what Kurz et al. (2011) and Bahar-Fuchs et al. (2013) reported, this review found that cognitive interventions have promising benefits for people with dementia or cognitive impairments. The differing conclusions may be explained through a slight difference in research question among the two previous reviews. Ten out of the seventeen studies included in this review had significant results for people with dementia or MCI. Cognitive stimulation interventions have consistent significant findings as reported in Table 4, with seven of the eight interventions included reporting significant findings. One study (Rozenfeld Olchik et al., 2012) even found participants with MCI had cognitive
performance levels that were higher than that of their normal controls, leading the authors to suggest cognitive plasticity is still possible for people with MCI.

Implications

For Practice

These findings have very positive practical implications for people with dementia in terms of improving quality of life in both retirement communities or at home since the most positive outcomes were measured from quality of life tools. With the interventions being tested in a wide variety of settings, the implications are positive for various locations. Also, positive results for cognition were found for seven of the interventions. By improving the cognitive ability of people with dementia, relationships can continue to be maintained, which can in turn increase quality of life (Kitwood & Bredin, 1992; Kinney & Rentz, 2005). Further studies on quality of life outcomes are encouraged given that only four studies were located with this type of outcome.

The level of cognitive ability that is shown by someone with dementia has an impact on how they are seen and perceived by the people around them, which effects how they are treated by their peers and family members (Scholl & Sabat, 2008). The more positive the perception, the better treatment people with dementia receive, which has social, behavioral, and psychological implications. Eight of the interventions had positive cognitive outcomes reported meaning cognitive ability can be maintained or even improved which can alter the treatment of people with dementia or mild cognitive impairment. If their peers or caregivers see an improvement, perceptions can be changed for the better.

These findings are important for the field of dementia because, as mentioned above, pharmacological options have mostly proven unsuccessful, and until a cure is found for dementia, there are millions of people that can benefit from cognitive interventions and other non-pharmacological methods. As shown in Table 4, successful cognitive interventions have been conducted through randomized controlled trials, so this type of intervention definitely shows promise in the field of dementia treatment.

For Research

From the results of this review, cognitive stimulation has consistently lead to more significant findings than the other two interventions, with seven of the eight
interventions leading to significant findings. This review can be used to inform researchers of the advantages or disadvantages of each cognitive intervention reviewed. It has been shown that cognitive training interventions and cognitive rehabilitation interventions do not have the consistent significant findings of cognitive stimulation interventions. Future research is necessary for cognitive stimulation with larger sample sizes, as was recommended in several included studies (Greenaway et al., 2012; Yamanaka et al., 2013; Barnes et al., 2009).

Future research on this topic could be improved through the standardization of outcome measures. It has been shown that numerous scales are used to measure the same outcome, as was observed with measures of cognition above. This review can shed light on the issues that surround cognitive interventions, namely, that consistent outcome measures are lacking. Future research would benefit through the use of consistent outcome measures.

**Differences in Cognitive Impairment**

The different levels of cognitive impairment among participants across the seventeen studies may help to explain the differing results among the three different types of cognitive interventions and outcomes. Although all seventeen studies had participants with either MCI or dementia, these different levels of cognitive impairment may have an effect on the efficacy of the interventions. Seven of the seventeen studies had participants with MCI, which is milder than dementia, but is likely to eventually lead to dementia.

Of those ten interventions with significant findings, eight of the studies had participants with a form of dementia, while the other two studies had participants with MCI. For the studies without significant findings, six of the seven had participants with MCI. These results suggest that people with MCI do not benefit from cognitive interventions nearly as much as those with dementia, which suggests that cognitive interventions may be more helpful for those with dementia.

**Limitations and Future Research Recommendations**

A limitation of this review was the inclusion and exclusion criteria. These led to a smaller number of articles, especially since only randomized controlled trials were included. While reviewing the literature prior to this review, those studies testing cognitive interventions that were not RCTs usually recommended conducting an RCT in
the future to test the intervention further. There are limitations to using RCTs such as their large expense and time-consuming nature, which often renders funding difficult to obtain. As with any research, it is very important during an RCT that researchers are rigorous and provide detailed information explaining the procedures and methods employed in order to assess its quality (Sibbald, 1998). Even with these limitations, RCTs are seen as the “gold standard” in research and research design because of the cause and effect nature of their results. Because of the rigor involved with randomized controlled trials, they were exclusively included in this review.

Another limitation in this review is possible selection bias in the RCTs reviewed. Also, people with severe dementia were more than likely unable to participate in many of the interventions. The results are more than likely not entirely generalizable to people with dementia because of this. RCTs are not usually generalizable across different people due to selection bias. In fact, the major limitation of RCTs is non-generalizability.

By only including RCTs, various other study designs are excluded, such as quasi-experimental. This is a limitation of this review, but, as described previously, RCTs are the gold standard in research and were therefore the only design included. A recommendation for future research involves using non-randomized controlled trials in order to broaden the number of studies included.

Further recommendations for future research include increasing the consistency of measures used for cognitive interventions. Consistency may help to provide insight on how the variation in intervention characteristics affects outcomes. Unfortunately, any observed differences may simply be the result of measurement differences.

CONCLUSION

In conclusion, evidence was found to support the notion that cognitive interventions do indeed have positive and significant findings for people with dementia or mild cognitive impairment as is evidenced in Table 4, with extreme emphasis upon cognitive stimulation interventions and their ability to provide significant results. Ten of the seventeen studies had positive and significant results. For the millions of people today with dementia, cognitive interventions are a viable option for treatment, as suggested by the research studies included in this review. They can improve cognitive abilities and
quality of life. It may be that the more positive the perception, the better treatment people with dementia receive, which has social, behavioral, and psychological implications. An increased emphasis on cognitive stimulation interventions and quality of life outcome measures will improve the body of research on cognitive interventions and add to the existing literature.
REFERENCES


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