Cognitive leisure activities and their role in preventing dementia: a systematic review

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Abstract

Background Dementia inflicts a tremendous burden on the healthcare system. Identifying protective factors or effective prevention strategies may lead to considerable benefits. One possible strategy mentioned in the literature relates to participation in cognitive leisure activities.

Aim To determine the effectiveness of cognitive leisure activities in preventing Alzheimer’s and other dementias among older adults.

Inclusion criteria

Types of participants. Adults aged at least 60 years of age with or without a clinical diagnosis of dementia that resided in the community or care setting.

Types of interventions. Cognitive leisure activities, defined as activities that required a mental response from the individual taking part in the activity (e.g. reading).

Types of outcomes. The presence or absence of dementia was the outcome of interest.

Types of studies. Any randomised controlled trials, other experimental studies, as well as cohort, case–control and cross-sectional studies were considered for inclusion.

Search strategy. A search for published and unpublished studies in the English language was undertaken with no publication date restriction.

Methodological quality Each study was appraised independently by two reviewers using the standard Joanna Briggs Institute instruments.

Data collection and analysis Information was extracted from studies meeting quality criteria using the standard Joanna Briggs Institute tools. Because of the heterogeneity of populations and interventions, meta-analyses were not possible and results are presented in narrative form.

Results There were no randomised controlled trials located that met inclusion criteria. Thirteen observational studies were included in the review; the majority were cohort design. Because of the heterogeneity of interventions, the study design, the way in which they were grouped and the different stages of life they were measured at, statistical pooling was not appropriate. Studies were grouped by stage of adult life participation when interventions were undertaken, that is, early adulthood, middle adulthood and late life. Five out of six studies showed a positive association between participating in activities and a reduced risk of developing Alzheimer’s disease and other dementias when interventions were undertaken in middle adulthood and six out of seven studies produced a positive association for late life participation. Results indicated that some activities might be more beneficial than others; however, results should be interpreted with caution because of the subjective nature of activity inclusion.

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The article is based on a systematic review, the full report of which can be found at http://www.joannabriggs.edu.au/pubs/systematic_reviews.php (in press).

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Conclusion

- Actively participating in cognitive leisure activities during mid- or late life may be beneficial in preventing the risk of Alzheimer’s disease and other dementias in the elderly; however, the evidence is currently not strong enough to infer a direct causal relationship.
- Participating in selected cognitive leisure activities may be more favourable than others but currently there is no strong evidence to recommend one over the other.

Key words: cognitive, dementia, leisure activity, prevention, systematic review.

Introduction

Dementia inflicts a tremendous burden of care on family, caregivers, healthcare professionals and resources, particularly in institutionalised care. The risk of Alzheimer’s disease (AD), the most common form of dementia, grows exponentially with age, doubling approximately every 5–6 years. As the number of people aged 60 and over increases, age-related diseases such as dementia are becoming major public health problems. AD has been projected to affect 81 million people worldwide by 2040.

Because of the irreversible nature of dementia, existing therapeutic interventions can only help control or reduce symptoms, and slow the disease’s progression. While treatment is not intended to cure the disease, identifying protective factors or effective prevention strategies may result in considerable benefits through prolonged independent quality of life expectancy, reduced social burden and improved quality of life. Australian data suggest that if the average onset of AD could be delayed by 5 years this would lead to a 50% reduction of new cases each year and a saving of $13.5 billion by 2020.

Apart from increasing age and genetics there are a number of possible risk factors for dementia, many of which have been researched to varying degrees with no strong conclusions currently reached. Leisure activities (activities that individuals engage in for enjoyment or well-being that are independent of work or activities of daily living) have been shown to produce health, social and psychological benefits. Current data suggest that participating in leisure activities may lower the risk of dementia by improving cognitive reserves. Leisure activities can be broadly divided into cognitive and physical activities, with this review focusing on cognitive activities. For the purpose of this review, cognitive activities involve information processing as a central component, such as viewing television, listening to the radio, reading, or playing games such as cards, crosswords or puzzles etc.

Methods

Review question

- What is the effectiveness of cognitive leisure activities in the prevention of Alzheimer’s and other dementias among older adults?

Inclusion criteria

Types of participants. Adults aged 60 years and older with/without a clinical diagnosis of dementia, living in the community or residential care setting.

Types of intervention. Any cognitive leisure activity that required a mental response from the person taking part in the activity, for example reading, watching movies, playing board games, playing musical instruments. Participation in activities could be undertaken during any stage of adult life and was not limited to people over 60 years of age.

Type of outcome. The presence or absence of dementia as determined by cognitive function tests, mental examination scores, DSM classification (Diagnostic and Statistical Manual of Mental Disorders), and other valid dementia diagnostic tools.

Type of studies. Randomised controlled trials, other experimental studies, cohort studies, case–control studies and cross-sectional studies were considered for this review.

Search strategy

A three-step search strategy was undertaken to identify both published and unpublished studies. Only articles published in the English language were included with no publication date restriction. Both authors felt that in general, there had not been a substantial advancement in regards to the types of cognitive activities people were involved in for leisure, for example card games, reading, puzzles; therefore, the decision to not include a date restriction was made. Electronic databases were searched in September 2008 and the maximum date limit of each database was used. The following databases were searched MEDLINE, CINAHL, EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL), PsychINFO, EBM Reviews, PubMed, Current Contents, Education Resources Information Center (ERIC), Austhealth, Health Source: Nursing/Academic Edition, Scopus, Ageline and Scirus. The search for unpublished studies included Proquest Dissertations and Theses, Index to Theses, The Networked Digital Library of Theses and Dissertations (NDLTD) and Theses Canada. Reference lists of all identified reports and articles were searched for additional studies.

Methodological quality

Data collection

Following the removal of duplicates, a total of 4892 references were located after searching through the above list of
bibliographic databases. Based on the information supplied in the title, abstract and subject headings 193 references were deemed relevant and where possible full text was sought. Articles were then evaluated against the inclusion criteria with 16 studies appearing to meet inclusion requirements.6,8–23

Critical appraisal
Studies underwent independent critical appraisal by two reviewers to determine methodological quality using the Joanna Briggs Institute (JBI) checklist for cohort/case–control designs (Appendix I). The checklist contains nine questions that require a yes, no or unclear response. All studies scored a minimum of five yeses and it was agreed by both reviewers that all 16 studies were of sufficient methodological quality to be accepted for the review. No disagreements between reviewers arose.

Data extraction
Data for each study were then extracted using the JBI extraction form for experimental/observational studies. Details about the interventions, populations, study methods and outcomes of significance to the review question were extracted.

Data synthesis
Because of the heterogeneity of interventions, the study design, the way in which they were grouped and the different stages of life they were measured at, statistical pooling was not appropriate and the findings have been summarised in narrative form. Because of the variation in activities and the way in which they were grouped, both authors met to discuss each study individually. The decision to include an activity or activity group was reached by consensus and is listed in Tables 2 and 3.

Results
Description of studies
On further investigation of the papers, it was evident that multiple papers were based on the same projects and discussion between both reviewers determined that 13 studies were included in this review – eight cohort studies and five case–control studies. No randomised controlled trials were located. The main reasons studies were excluded were because they did not measure dementia (many assessed cognition), they examined a combination of interventions that included some kind of cognitive activity that did not directly link to the data, interventions were not leisure activities (i.e. occupation-related activities) or they were studies based on the same project. Eight of the studies were undertaken in the USA,9–12,14,16,19,20 two in Sweden,13,22 one in China,18 one in Japan23 and one in Europe.21 Please refer to Table 1 for an overview of study characteristics.

Seven studies investigated the relationship between leisure activities and AD and other dementias undertaken in late life (at least 65+ years).9–14,21 three studies looked exclusively at activities undertaken in midlife (40–59 years)16,18,23 and three studies examined activity participation in early and middle adulthood (approximately 20–60 years).19,20,22 Only one of the three studies however distinguished between participation in early and middle adulthood.20

As mentioned previously, all studies scored positive responses to at least half of the questions on the critical appraisal instrument. Most studies did not score favourably to questions related to describing and analysing people who withdrew from the study, describing how bias was minimised in selecting cases and controls and whether the patients were at a similar point in the course of their condition/illness. The study scoring the highest in terms of methodological quality was Wang et al.13

Results are grouped by stage of adult life when interventions were undertaken. As some of the studies looked at early and middle adulthood jointly, they were grouped together.

Activities undertaken in early and middle adulthood
Six studies were concerned with examining the relationship between participation in cognitive leisure activities and AD in early and middle adulthood (commonly 20–60 years) and all (minus one18) were case–control design. In addition to measuring AD, He et al.18 and Crowe et al.23 also measured dementia. Descriptions of the activities examined are provided in Table 2.

Friedland et al. looked at the relationship between non-occupational activities and AD between the ages of 20 and 60 years.20 Controls were friends or neighbours of cases or were members of the same organisations to which the cases belonged, matched for age and gender. Information regarding participation in 26 activities was ascertained through questionnaires. Activities were grouped into intellectual, passive and physical activities.

The number of cases analysed was 193 while there were 358 controls. Results showed that controls were significantly more active in midlife in all activities when compared with cases. The odds ratio (OR) for AD in people performing less than the mean value of activities was 3.85 (95% confidence interval (CI), 2.65–5.58). Controls also participated in intellectual activities at a significantly higher intensity than cases in both early and middle adulthood. It was concluded that low participation in activities in midlife could potentially be a risk factor for AD.

Fritsch et al. studied the association between participating in mentally stimulating leisure activities during a person’s lifespan and risk of AD in later life.19 Altogether 264 cases were recruited. The researchers decided to include two control groups; however, as there were no differences in responses they were later combined. Information pertaining to participation in 16 activities was ascertained through questionnaires. A factor analysis was then undertaken, which identified three activity factors: novelty seeking, exchange of ideas and social.

The researchers noted that the effort made to match cases to control was not completely successful. More frequent participation in both novelty seeking (OR 0.248, 97.5% CI, 0.139–0.443) and exchange of ideas activities (OR 0.695,
Table 1 Study characteristics

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Stage of life involved in activity</th>
<th>Sample size</th>
<th>Type of dementia</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friedland et al. 2001</td>
<td>Case-control</td>
<td>Early and middle adulthood</td>
<td>193 cases, 358 controls</td>
<td>AD</td>
<td>Not explicitly stated but information obtained about the third, fourth, fifth and sixth decades of life from participants with a mean age in their 70s</td>
</tr>
<tr>
<td>Fritsch et al. 2005</td>
<td>Case-control</td>
<td>Early and middle adulthood†</td>
<td>264 cases, 545 controls</td>
<td>AD</td>
<td>Not explicitly stated but information obtained regarding participation between the ages 20 and 60.</td>
</tr>
<tr>
<td>Crowe et al. 2003</td>
<td>Case-control</td>
<td>Early and middle adulthood†</td>
<td>107 twin pairs</td>
<td>AD</td>
<td>Not explicitly stated but information was self-reported over 20 years before clinical evaluation for participants born between 1886 and 1925</td>
</tr>
<tr>
<td>Lindstrom et al. 2005</td>
<td>Case-control</td>
<td>Middle adulthood</td>
<td>135 cases, 331 controls</td>
<td>AD</td>
<td>Not explicitly stated but information obtained about fifth and sixth decades of life for participants born between 1915 and 1944</td>
</tr>
<tr>
<td>He et al. 2000</td>
<td>Cohort</td>
<td>Middle adulthood</td>
<td>5055 (baseline), 3024 (5-year follow up), 1203 (10-year follow up)</td>
<td>AD, Dementia</td>
<td>5 and 10 years</td>
</tr>
<tr>
<td>Kondo et al. 1994</td>
<td>Case-control</td>
<td>Middle adulthood</td>
<td>60 cases, 2 controls for each case (120)</td>
<td>AD</td>
<td>Not explicitly stated but information obtained about the fifth and sixth decades of life from participants aged 49–89 years</td>
</tr>
<tr>
<td>Fabrigoule et al. 1995</td>
<td>Cohort</td>
<td>Late life</td>
<td>2040</td>
<td>Dementia</td>
<td>1 and 3 years</td>
</tr>
<tr>
<td>Wang et al. 2002</td>
<td>Cohort</td>
<td>Late life</td>
<td>776</td>
<td>Dementia</td>
<td>Mean 6.4 years</td>
</tr>
<tr>
<td>Scarmeas et al. 2001</td>
<td>Cohort</td>
<td>Late life</td>
<td>1772</td>
<td>AD</td>
<td>Mean 2.9 years</td>
</tr>
<tr>
<td>Wilson et al. 2002</td>
<td>Cohort</td>
<td>Late life</td>
<td>801</td>
<td>AD</td>
<td>Mean 4.5 years</td>
</tr>
<tr>
<td>Wilson et al. 2002</td>
<td>Cohort</td>
<td>Late life</td>
<td>835</td>
<td>AD</td>
<td>Mean 4.1 years</td>
</tr>
<tr>
<td>Wilson et al. 2007</td>
<td>Cohort</td>
<td>Late life</td>
<td>775</td>
<td>AD</td>
<td>Mean 3.5 years</td>
</tr>
<tr>
<td>Verghese et al. 2003</td>
<td>Cohort</td>
<td>Late life</td>
<td>469</td>
<td>Dementia</td>
<td>Median 5.1 years</td>
</tr>
</tbody>
</table>

†Study did not separate results for participation during different stages of life. AD, Alzheimer’s disease.
<table>
<thead>
<tr>
<th>Study</th>
<th>Leisure activities investigated in study</th>
<th>Activities included in this review</th>
<th>Measurement of activities</th>
<th>Were activities measured individually, in a group or both?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friedland et al. 2001</td>
<td>Physical • Baseball/football/basketball/soccer/hockey • Gym • Racquet sports • Cycling • Golf and bowling • Gardening • Ice skating/roller skating • Jogging and swimming • Walking • Intellectual • Reading • Jigsaw puzzles • Crossword puzzles • Playing a musical instrument • Other crafts • Painting/drawing/other art • Woodworking • Letter writing • Playing cards • Playing board games • Make home repairs/handy work • Knitting/crocheting/needlework</td>
<td>Intellectual • Reading • Jigsaw puzzles • Crossword puzzles • Playing a musical instrument • Other crafts • Painting/drawing/other art • Woodworking • Letter writing • Playing cards • Playing board games • Make home repairs/handy work • Knitting/crocheting/needlework</td>
<td>• Did you participate in the activity at least once per month? • If so how many hours per month in your 20s and 30s? • And in your 40s and 50s? • Diversity (no. of activities) calculated • Intensity (hours/month) calculated • Percentage intensity (% of total activity hours devoted to each category) calculated</td>
<td>Group</td>
</tr>
<tr>
<td>Fritsch et al. 2005</td>
<td>Novelty seeking • Learn a new skill • Learn about a new subject • Do things that are challenging mentally • Solve a problem • Get a new experience • Take up a new hobby • Social • Visit a place you had been before • Visit a new place • Spend time with friends • Passive • Rest or take a nap • Spend time alone</td>
<td>Novelty seeking • Learn a new skill • Learn about a new subject • Do things that are challenging mentally • solve a problem • Get a new experience • Take up a new hobby • Exchange of ideas • Discuss politics • Discuss ideas</td>
<td>How often do you look for opportunities to do each activity (from age 20 to 60 years)?</td>
<td>Group</td>
</tr>
</tbody>
</table>
Crowe et al. 2003

- Intellectual-cultural
  - Reading
  - Radio/TV
  - Social visits
  - Cultural activities (theatre, cinema)
  - Self-improvement
  - Clubs/organisations
  - Studies
  - Outdoor activities
  - Playing sports

- Domestic activity
  - Home and family
  - House and gardening

Before the age of 40, were you regularly involved in each of the following activities? (yes/no)

Lindstrom et al. 2005

- TV
  - TV
  - Social
    - Music
    - Social clubs
    - Talking on the phone/visiting others
    - Attending church/synagogue activities

- Intellectual
  - Reading
  - Jigsaw puzzles
  - Crossword puzzles
  - Playing a musical instrument
  - Other crafts
  - Painting/drawing/other art
  - Woodworking
  - Letter writing
  - Playing cards
  - Playing board games
  - Make home repairs/handy work
  - Knitting/crocheting/needlework

- Physical
  - Baseball/football/basketball/soccer/hockey
  - Gym
  - Racquet sports
  - Cycling
  - Golf and bowling
  - Gardening
  - Ice skating/roller skating
  - Jogging and swimming
  - Walking

- Did you ever participate in each activity? Group

- If so how many hours per month?
- Daily activity hours calculated
- Daily per cent intensity calculated
<table>
<thead>
<tr>
<th>Study</th>
<th>Leisure activities investigated in study</th>
<th>Activities included in this review</th>
<th>Measurement of activities</th>
<th>Were activities measured individually, in a group or both?</th>
</tr>
</thead>
<tbody>
<tr>
<td>He et al. 2000</td>
<td>Activities at 5-year follow up • No physical activities • No group activities • No reading/writing</td>
<td>Activities at 5-year follow up • No reading/writing</td>
<td>• Exposure to psychosocial risk factors (question not detailed)</td>
<td>Individual</td>
</tr>
<tr>
<td></td>
<td>Activities at 10-year follow up • No physical activities • No community activities • No outdoor activities • No group activities • Not visiting friends • Not taking care of family • No social activities • No touring • No gardening • No reading/writing • No watching television • No lobby game</td>
<td>Activities at 10-year follow up • No reading/writing • No watching television • No entertainment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kondo et al. 1994</td>
<td>1. (a) Outdoor leisure (b) Indoor leisure (c) Leisure requiring partners (d) Leisure without partners (e) Leisure with physical activity (f) Leisure without physical activity (g) Leisure requiring skills (h) Leisure without skills</td>
<td>2. (f) Rarely reads books/newspapers</td>
<td>• Give us a typical use of your leisure time? (up to five choices could be selected)</td>
<td>Individual</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Questioned about psychosocial behaviours (exact question not defined)</td>
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</tr>
</tbody>
</table>

1 Insufficient information was provided in the paper and therefore not included in this review.
Table 3 Intervention details for studies measuring activity participation during late adulthood

<table>
<thead>
<tr>
<th>Study</th>
<th>Activities investigated in study</th>
<th>Activities included in this review</th>
<th>Measurement of activities</th>
<th>Were activities measured individually, in a group or both?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabrigoule et al. 1995</td>
<td>• Sports/gym • Travelling • Family/friend visits • Child care • Golden age clubs • Reading • TV • Parlour games • Gardening • Odd jobs/knitting</td>
<td>• Reading • TV</td>
<td>Participants were asked ‘Do you participate in?’ for first five activities (yes/no) Participants were asked about participation and given four possible choices for the last five activities (yes without difficulty, yes with difficulty, no because of difficulties, no for other reasons) Difficulties = deficiencies/disabilities</td>
<td>Individually</td>
</tr>
<tr>
<td>Wang et al. 2002</td>
<td>Mental • Reading • Writing • Studying • Crosswords • Paint • Drawing Physical • Swimming • Walking • Gymnastics Social • Theatre/concerts/art • Travelling • Playing cards/games • Participating in social groups Productive • Gardening • Housekeeping • Cooking • Working for pay post retirement • Volunteer work • Sewing/knitting/crocheting/weaving Recreational • TV • Radio</td>
<td>Mental • Reading • Writing • Studying • Crosswords • Paint • Drawing Social • Theatre/concerts/art • travelling • Playing cards/games • Participating in social groups Productive • Gardening • Housekeeping • Cooking • Working for pay post retirement • Volunteer work • Sewing/knitting/crocheting/weaving Recreational • TV • Radio</td>
<td>• Do you regularly engage in any particular activities/organisations? • Specify types of activities/organisations • Frequency of participation calculated (daily, weekly, monthly, annually)</td>
<td>Group</td>
</tr>
<tr>
<td>Study</td>
<td>Activities investigated in study</td>
<td>Activities included in this review</td>
<td>Measurement of activities</td>
<td>Were activities measured individually, in a group or both?</td>
</tr>
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<td>---------------------</td>
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<td>------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td>Scarmeas et al. 2001</td>
<td>• Intellectual: Reading • Cards/games/bingo • Going to classes • Physical: Walking • Physical conditioning • Social: Family/friends visits • Being visited by family/friends • Movies/restaurant/sporting events • Volunteer work • Going to a club/centre • Church/temple • Knitting/music/other hobby † • TV/radio</td>
<td>Intellectual: • Reading • Cards/games/bingo • Going to classes • Knitting/music/other hobby † • TV/radio</td>
<td>Participation during the month preceding the interview 1 point to each activity and an aggregate score assigned (low &lt;6, high &gt;6)</td>
<td>Both</td>
</tr>
<tr>
<td>Wilson et al. 2002</td>
<td>• Cognitive: TV • Radio • Reading newspapers • Reading magazines • Reading books • Playing games • Museum visit • Physical activity: Walking • Gardening/yard work • Callisthenics/general exercise • Cycling • Swimming/water exercise</td>
<td>TV • Radio • Reading newspapers • Reading magazines • Reading books • Playing games • Museum visit</td>
<td>Asked current frequency of participation with five possible responses: • Every day or about • Several times a week • Several times a month • Several times a year • Once a year or less =⇒ Summary measure of cognitive activity calculated</td>
<td>Group</td>
</tr>
<tr>
<td>Wilson et al. 2002&lt;sup&gt;11&lt;/sup&gt;</td>
<td>Cognitive</td>
<td>Physical</td>
<td></td>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>• TV</td>
<td>• Walking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Radio</td>
<td>• Jogging/running</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Reading newspapers</td>
<td>• Gardening/yard work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Reading magazines</td>
<td>• Dancing/callisthenics/general exercise</td>
<td></td>
<td></td>
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<tr>
<td>• Reading books</td>
<td>• Golf</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>• Playing games</td>
<td>• Bowling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Museum visit</td>
<td>• Cycling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>• Swimming/water exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wilson et al. 2007&lt;sup&gt;12&lt;/sup&gt;</th>
<th>Cognitive</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reading newspapers</td>
<td>• Reading newspapers</td>
<td></td>
</tr>
<tr>
<td>• Playing games</td>
<td>• Playing games</td>
<td></td>
</tr>
<tr>
<td>• Library visits</td>
<td>• Library visits</td>
<td></td>
</tr>
<tr>
<td>• Attending a play</td>
<td>• Attending a play</td>
<td></td>
</tr>
</tbody>
</table>

Note: Not all activities listed

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<table>
<thead>
<tr>
<th>Verghese et al. 2003&lt;sup&gt;9&lt;/sup&gt;</th>
<th>Cognitive</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reading</td>
<td>• Reading</td>
<td></td>
</tr>
<tr>
<td>• Writing</td>
<td>• Writing</td>
<td></td>
</tr>
<tr>
<td>• Crosswords</td>
<td>• Crosswords</td>
<td></td>
</tr>
<tr>
<td>• Playing board games/cards</td>
<td>• Playing board games/cards</td>
<td></td>
</tr>
<tr>
<td>• Participating in organised group discussions</td>
<td>• participating in organised group discussions</td>
<td></td>
</tr>
<tr>
<td>• Musical instruments</td>
<td>• Musical instruments</td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>Physical</td>
<td></td>
</tr>
<tr>
<td>• Tennis</td>
<td>• Golf</td>
<td></td>
</tr>
<tr>
<td>• Swimming</td>
<td>• Cycling</td>
<td></td>
</tr>
<tr>
<td>• Dancing</td>
<td>• Dancing</td>
<td></td>
</tr>
<tr>
<td>• Group exercise</td>
<td>• Group exercise</td>
<td></td>
</tr>
<tr>
<td>• Team games (bowling)</td>
<td>• Team games (bowling)</td>
<td></td>
</tr>
<tr>
<td>• Walking</td>
<td>• Walking</td>
<td></td>
</tr>
<tr>
<td>• Climbing stairs</td>
<td>• Climbing stairs</td>
<td></td>
</tr>
<tr>
<td>• Housework</td>
<td>• Housework</td>
<td></td>
</tr>
<tr>
<td>• Babysitting</td>
<td>• Babysitting</td>
<td></td>
</tr>
</tbody>
</table>

The study analysed activities individually first then grouped activities into three continuous factors (Intellectual, Physical, Social). These activities were not grouped.

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*Group*

<table>
<thead>
<tr>
<th>Asked current frequency of participation with five possible responses:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Every day or about</td>
</tr>
<tr>
<td>• Several times a week</td>
</tr>
<tr>
<td>• Several times a month</td>
</tr>
<tr>
<td>• Several times a year</td>
</tr>
<tr>
<td>• Once a year or less</td>
</tr>
</tbody>
</table>

=> Summary measure of cognitive activity calculated

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<td>• Once a year or less</td>
</tr>
</tbody>
</table>

=> Summary measure of cognitive activity calculated

---

*Both*

<table>
<thead>
<tr>
<th>Frequency of participation (daily, several days per week, once weekly, monthly, occasionally, never)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Then converted to scale of activity-days per week</td>
</tr>
</tbody>
</table>

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<sup>11</sup>The study analysed activities individually first then grouped activities into three continuous factors (Intellectual, Physical, Social). These activities were not grouped.
97.5% CI, 0.467–1.034) were significantly associated with decreased odds of AD. It was concluded that participation in a diverse range of mentally stimulating leisure activities in early and middle adulthood may be associated with a lower risk of developing AD.

Lindstrom et al. analysed the relationship between television watching and the incidence of AD.16 There were 135 cases recruited as well as 331 healthy controls. Cases were seen to have significantly lower levels of completed education and current income. Cases also spent a significantly larger per cent of their leisure time on television viewing compared with controls. For every hour increase in daily television watching during midlife there was a 1.3 times increased risk of belonging to the case group (OR 1.32, 95% CI, 1.08–1.62). An increase in daily intellectual activity hours was associated with a reduced risk of being in the case group (OR 0.84, 95% CI, 0.72–0.98). The authors concluded that participating in television viewing was associated with an increased risk of developing AD whereas participating in other intellectually stimulating activities was associated with a reduced risk of developing AD.

A sample of 107 same-sex twins discordant for AD and other dementias were the focus of the study by Crowe et al.22 A twin pair was classified as discordant if one of the twins remained alive (i.e. without dementia) for at least 5 years after the onset of dementia of the other twin OR if the twin without dementia died during the 5-year follow-up interval but remained alive without dementia for a time interval specified in a sliding scale for survival. Cases and their partners (the other twin) were followed up every 18 months. Data regarding participation in leisure activities were self-reported by the subjects more than 20 years before clinical evaluation via a questionnaire.

Activities were classed under three headings: intellectual-cultural, self-improvement and domestic activity. Results showed that more frequent participation in overall leisure activities was associated with significantly decreased odds of AD (OR 0.54, 95% CI, 0.29–1.00) and dementia (OR 0.63, 95% CI, 0.39–1.00). Women showed a significantly reduced risk of AD when they participated in intellectual-cultural activities compared with men (OR 0.42, 95% CI, 0.18–1.00). The authors concluded that more frequent participation in leisure activities during early and middle adulthood may protect against AD and other dementias; however, not all activities may be equally protective.

Kondo et al. undertook a case–control study to investigate risk factors for AD.23 Two same-sex controls were matched for each case; controls were selected by the neighbours of the cases who had agreed to participate. A structured questionnaire was developed that contained over 100 questions, with most questions focused on the fifth and sixth decades of life.

The study included 60 cases (nearly 75% were women) and 120 controls. It should be noted that the age ranges of cases and controls were wide with some participants as young as 43 years, which may have implications on results. Of the 10 psychosocial behaviours listed, the only one of interest for this review was ‘Rarely reads books or newspapers’. A statistically significant result was found for this specific behaviour with close to 50% of cases rarely reading books or newspapers compared with only 8.3% of controls (OR 9.6, 95% CI, 4.2–21.9, P < 0.001). The authors of the study concluded that psychosocial behaviours (incorporating reading books or newspapers) were a significant risk factor for development of AD.

The final study for this section used an age-stratified cluster community-based prospective cohort.18 The study was conducted in Shanghai China and consisted of community-dwelling people aged over 55 years. The aim of the study was to determine the relationship between psychosocial factors and the risk of developing AD. It is important to note that the study also measured dementia; however, the focus was on AD and relative risks (RR) were only calculated for AD.

A structured questionnaire was provided with participants asked if they were exposed or non-exposed to each factor. A number of different activities were listed as leisure activities; however, to fit with the review’s inclusion criteria, only reading/writing, watching television and entertainment were suitable activities and are the only ones considered. At the 5-year follow-up no reading/writing was associated with a RR = 2.44 (95% CI, 1.51–3.92). No entertainment produced a RR = 1.80 (95% CI, 1.0–3.00). Results for television viewing was not provided at the 5-year follow up with the authors only listing those factors that had a RR greater than 1.

At the 10-year follow up, additional variables were examined along with those previously examined. Again no reading/writing was associated with a RR of more than 1 (RR = 4.18, 95% CI, 2.44–7.15). Not watching television resulted in a RR = 1.53 (95% CI, 0.82–2.85) and no entertainment RR = 1.51 (95% CI, 0.20–11.4). The authors concluded that a lack of leisure activities such as reading may impact on the onset and development of AD.

Summary
Out of six studies looking at the relationship between participation in cognitive leisure activities during early and middle adulthood and the risk of AD and other dementias in late life, all studies (barring one,16 which looked at television viewing as an individual activity) showed a positive association between participation and development of AD and other dementias. Results suggest that cognitive leisure activities may have a protective effect; however, not all activities may be equally protective. Two studies looked at reading at an individual level – Kondo et al.23 and He et al.18 (who looked at reading and writing together), both indicating beneficial results.

Activities undertaken in late life
Participating in cognitive activities during later life (commonly 65 years and over) and its subsequent impact in the prevention of AD and other dementias was the focus of the remaining seven cohort studies. Table 3 provides details on the different interventions used across studies.
Wilson et al. surveyed a biracial community in Chicago. Participations were asked to rate current frequency of participation in selected cognitive and physical activities. Follow up was measured using a stratified random sample of 842 people who were deemed free of AD. A diagnosis of AD occurred in 139 people. Results at follow up indicated that a one-point increase in cognitive activity score was significantly associated with a 64% reduction in risk of incident AD (OR 0.36, 95% CI, 0.20–0.65), with the authors concluding in a positive association between the frequency of participation in cognitively stimulating activities and a decreased risk of incident AD in later life.

A cohort study containing 1772 individuals without dementia aged 65 years or older was conducted by Scarmeas et al. to examine the effects of participating in leisure activities. Self-reported participation in 13 leisure activities was ascertained and an aggregated activity score was calculated for each participant. Two hundred and seven people involved in the project were diagnosed with AD or other dementias during follow up. The findings suggest a significant relationship between the degree of leisure activity and risk of developing AD when all activities were considered as the risk of dementia was decreased in participants involved in higher amounts of leisure activities (RR = 0.62, 95% CI, 0.46–0.83). When leisure items were classified into intellectual, physical and social groups, the intellectual factor was associated with the lowest RR of dementia (RR = 0.76, 95% CI, 0.61–0.94). On an individual level reading was most strongly associated with a reduced risk of dementia (RR = 0.49, 95% CI, 0.35–0.68). The authors concluded there was a positive association between participation in leisure activities and reduced incidence of AD and other dementias.

The Religious Orders Study, a longitudinal cohort study, examined Catholic nuns, priests and brothers (aged at least 65 years) who did not have AD at enrolment, and consented to annual clinical evaluations and brain donation at time of death. Out of 801 participants, 21 died before first follow up and 40 had not yet reached the date of their first follow up. Frequency of participation in cognitive activities was measured.

One hundred and eleven subjects developed AD during the study. When age, sex and education were controlled for, a significant reduction in the risk of AD by 33% was shown in a one-point increase in cognitive activity (hazard ratio (HR) = 0.67, 95% CI, 0.49–0.92). It was concluded that frequent participation in cognitively stimulating activities was associated with a reduced risk of AD.

The fourth study, an ongoing longitudinal clinicopathological study of risk factors for common chronic conditions, recruited participants from continuous care retirement communities and subsidised housing facilities. Past and current frequency of participation in cognitive activities was ascertained using a structured questionnaire. Current activity was measured annually for a maximum follow up of 5 years. Only a limited number of activities were listed in the paper and it was unclear if these were all that were investigated.

Of the 775 people eligible to participate in the study 84 died. Ninety subjects developed AD during the follow-up period with results showing a significant association between increased participation in cognitive activity and a reduced incidence of AD (HR = 0.58, 95% CI, 0.44–0.77). The authors concluded that the level of cognitively stimulating activity in older people is related to the risk of developing AD.

Verghese et al. looked at the relationship between cognitive and physical leisure activities and the risk of dementia. Subjects were between 75 and 85 years of age, were not diagnosed with dementia and resided in the community at baseline data collection. Various types of dementia were classified; however, results were broadly classified as dementia.

Participants were asked about their frequency of participation and a cognitive-activity score using activity-days per week was generated. Assessments were conducted at baseline and then at every 12–18 months. Follow up was conducted over a maximum of up to 21 years (mean of 5.1 years). One hundred and twenty-four people developed dementia. An increase in cognitive activity was significantly associated with a reduced risk of dementia (HR = 0.93, 95% CI, 0.90–0.97). An increase by one point on the cognitive-activity score corresponded to a 7% reduction in the risk of dementia.

On an individual level the following activities showed a significant association with reduced risks of dementia: reading, playing board games and playing musical instruments. The authors concluded that increased participation in leisure activities was associated with a reduced risk of dementia.

Results were somewhat different in the study by Fabrigoule et al. who followed a cohort of older people to study risk factors and predictors of dementia. A total of 2043 people had at least one complete follow up.

Information on 10 activities was ascertained; however, only two were deemed suitable for this review. Eighty-four people were diagnosed as incident cases of dementia. Both activities (reading and watching TV) were associated with a lower risk of dementia; however, once age and cognitive performance were controlled for neither of the two activities remained significant. Further analysis revealed that participating in two or three activities was significantly associated with a lower risk of dementia, with three activities having a stronger protective effect than two (RR = 0.20, 95% CI, 0.04–0.87 vs. RR = 0.41, 95% CI, 0.18–0.90).

The authors concluded that some leisure activities but not others were associated with a lower risk of dementia but for this review the two activities deemed to be cognitive-based were not associated with a reduced risk when analysed individually.

The final study in the late life group was another longitudinal population-based study. People had to be at least 75 years of age and without a diagnosis of dementia at the beginning of the project. Information on five different groups of leisure activities was determined by interviews; however, this review focused
on all groups except physical activities. A person belonged to a group if they participated in at least one of the group’s listed activities.

There were 123 incident cases of dementia diagnosed. Participants undertaking mental, social or productive activities had a lower incidence of dementia, which were maintained when various factors were controlled for (adjusted relative risks were $RR = 0.54$, $95\% CI$, $0.34–0.87$ for mental activity, $RR = 0.58$, $95\% CI$, $0.37–0.91$ for social activity, and $RR = 0.58$, $95\% CI$, $0.38–0.91$ for productive activity). Participation in recreational activity was not significantly associated with a lowered risk of incident dementia. The authors concluded that frequent participation in mental, social or productive activities was associated with a reduced incidence of dementia.

**Summary**

From the seven cohort studies examining the association between participation in cognitive leisure activities undertaken later in life and the risk of developing AD and other dementias, all but one study\(^{21}\) revealed a positive association between active participation and a reduced risk of AD and other dementias. Three studies examined individual activities with two finding that reading had a positive association with a lowered risk of dementia.

**Discussion**

The review aimed to determine if participating in cognitive leisure activities was effective in the prevention of dementia. No randomised controlled trials were located. Results from 13 observational studies (mostly cohort) indicate that there is some evidence to suggest that participating in cognitive leisure activities, either during mid-life or late life, may have a protective effect on the prevention of AD and other dementias; however, because of the quality of the included studies, particularly their design and the heterogeneity of the population and the interventions, results should be interpreted with caution.

Because of the nature of the observational studies included in this review bias cannot be ignored. Depending on the type of study design used publication bias, selection bias, survival bias, recall bias or responder bias need to be considered. Most studies also used surrogates for cases because of their limited cognitive capacity, which may have led to under- or over-reporting of results; however, this is standard in dementia research and cannot be avoided. Only including articles in English may have also influenced results. The sample sizes of studies varied dramatically and some of the types of populations sampled were quite specific.\(^{10}\) Targeting a specific population has its benefits in terms of potentially reducing some confounding factors such as gender, socioeconomic status and occupation; however, the applicability of the results for the general population may be questionable.

Alzheimer’s disease and other dementias were diagnosed using the same criteria in all of the studies (i.e. versions of either the National Institute of Neurological and Communicative Disorders and Stroke/Alzheimer’s Disease and Related Disorders Association criteria (NINCDS-ADRDA) or the Diagnostic and Statistical Manual of Mental Disorders (DSM)); however, some studies measured both but did not clearly differentiate between them in their results. Activity participation was measured using a number of different outcomes, some using a basic yes/no format while others investigated further to ascertain frequency, intensity and diversity of participation. It became evident that there is a lack of clarity as to what constitutes a cognitive leisure activity. There was also a lack of transparency concerning the way that activities were grouped together. It became quite clear that most activities could fit under multiple headings, as they often comprised of a variety of social, physical and cognitive components. There is limited evidence on the relationship between social networks (i.e. marital status, social ties and involvement in social activities) and the risk of dementia.\(^{14-21}\) Findings have shown a beneficial association; however, like our review results, these findings should be interpreted with caution because of methodological limitations. Partaking in physical activities has been the most common activity measured to date and another review has been conducted, which looks at the effects of physical leisure activities and their role in the prevention of dementia.\(^{27}\)

Because of this lack of standardisation across studies in terms of activity definition and grouping, combined with the heterogeneity in the breakdown of results, the reviewers felt that a meta-analysis was not justifiable, even though other authors had done so.\(^{28}\) It is important to note that the authors are aware that the decision to include some activities and not others into this review was subjective and subsequently has implications on the reliability of results.

The most common activity listed was reading, followed by playing cards, games or crossword puzzles, watching television and listening to the radio or music. Most studies had either not broken down each activity at an individual level or not described it in their report. Examining activities at an individual level may assist in reducing the problem of variation in categories and would be more prescriptive for individuals; however, more comprehensive and specific detail would be required, such as activity frequency and intensity. All studies except Kondo et al.\(^{23}\) adjusted for potential confounding factors with some doing so more extensively than others. The main factors controlled for were age and gender, followed by education, and cognitive performance/status. It was interesting to note that although the presence of Apolipoprotein E (APOE) e4 alleles\(^{29,30}\) is a recognised risk factor for dementia only two studies controlled for it. This may have been due first to the age of the study and second to the availability of time and resources such as access to screening methods. Most studies, particularly those in late life, adjusted for baseline cognitive performance/status to account for the preclinical stages of dementia, as an individual in the preclinical stages of dementia may start to decrease or disengage from activity, commonly referred to as reverse causation. Some literature suggests that an accelerated decline in memory may begin up to 7 years before dementia is diagnosed,\(^9\) while others have suggested...
10 years. Various medical and physical conditions as well as depressive symptoms were also controlled for, with Sarmiento et al. pointing out that health limitations, problems or difficulties can interfere with desired social or leisure activities. Because of the nature of studies it should also be noted that there may be potential confounding factors that have not been accounted for that could have influenced the results of each study. In an ideal study measuring the role of cognitive activities in preventing dementia, all known risk factors for dementia would be controlled for.

Regardless of the methodological issues described above and the inability to conduct a meta-analysis, the majority of studies showed some kind of beneficial effect on the prevention of AD and other dementias when people participate in cognitive leisure activities. For studies focusing on participation in midlife, five out of six showed that a reduction in participation in cognitive activities over four decades increases the probability of developing AD and other dementias. For studies focusing on involvement in cognitive leisure activities in later life, six out of seven also show that a reduction in activity participation over the later decades of one’s life increases the likelihood of AD and other dementias. Results also show that some individual activities might be more effective than others; reading was one such intervention noted and further research is warranted. It may also be important to examine the different cognitive components involved in each activity, that is, information processing, memory, problem solving and creativity, as each activity may use multiple components at different strengths.

The results of this review are consistent with other literature suggesting cognitive leisure activities are beneficial to cognition and may provide protective effects against dementia. Valenzuela and Sachdev undertook a meta-analysis examining the effects of education, occupation, pre-morbid IQ and mental activities on the risk of dementia. Over 29,000 subjects from 22 longitudinal cohort studies were included. Results showed that participating in mentally stimulating leisure activities was associated with an overall risk reduction of 50% (OR 0.50, 95% CI, 0.42–0.61). This figure came from the results of six studies; all minus one were included in our review and all looked at late life participation. This meta-analysis used a variety of terms to describe mental activities and the criteria as to what constituted a mental activity, or when the intervention was undertaken or measured were not detailed in the study.

Evidence is also emerging in the area of cognitive training. Cognitive training or cognitive interventions are designed to maintain or enhance cognitive abilities and encompass activities intended to assist in areas such as memory training, reasoning training and speed training. One of the limitations noted in the literature of this type of activity is that of transferability of effect. Some research has shown that only the specific task the individual is training in will improve and can therefore not be generalised to other cognitive tasks. However, more recent research has shown a transfer of effect in a number of controlled trials. With recent popularity in electronic gaming devices that incorporate brain training programs, more research may become available in the upcoming years. Such activities were not deemed as ‘leisure activities’ by the authors of this review and were therefore not included; however, the authors acknowledge that cognitive training appears to be a promising avenue for research.

Although adverse effects were not an outcome listed in our inclusion criteria, the studies included in the review did not describe any adverse effects associated with participating in cognitive leisure activities. Work done by Menec has shown that greater activity level is associated with increased happiness, and different types of activities (e.g. social vs. solitary) are positively related to different outcome measures such as function and mortality. Fratiglioni et al. and Wilson et al. have also shown that social factors such as loneliness and reduced social network may be associated with an increased risk of dementia. Therefore, it would seem justifiable to suggest participating in cognitive leisure activities is not linked to any adverse effects, it may protect against the development of dementia, it may make the individual happy and allow them to socialise with others.

How can the results of this review be explained? As many of the researchers in the included studies note, the positive association with activity involvement may be due to the influence of preclinical dementia. Most studies accounted for this and assessed for baseline cognitive status/ performance and then determined a cut-off score; however, as indicated previously, memory decline may begin many years before diagnosis and therefore this cannot be completely excluded. Unmeasured confounding factors may have also played a role, with a range of different factors adjusted for across studies.

If these associations were in fact related to participation in cognitive leisure activity it may be explained in terms of the cognitive reserve theory. The concept of ‘reserve’ is a complex theory that has evolved over time but states that ‘innate intelligence as well as aspects of life experience may supply a reserve in the form of a set of skills or repertoires allowing some people to cope with progressing dementia pathology better than others’. Also described in the literature is the ‘use it or lose it’ proverb that suggests that changes in everyday experiences and activity patterns may result in disuse and subsequent atrophy of cognitive skills and processes. There are many variations and interpretations of the reserve theory; however, to date, the exact mechanisms have not been established. Whichever interpretation is suggested, active involvement in mental stimulation may play a role in preserving cognition or hindering cognitive decline.

Implications for practice
1 Actively participating in cognitive leisure activities during mid- or late life may be beneficial in preventing the risk of AD and other dementias in the elderly; however, the evidence is currently not strong enough to infer a direct causal relationship.
2 Participating in selected cognitive leisure activities (i.e. reading) may be more favourable than others but currently there is no strong evidence to recommend one over the other.

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3 Individuals who participate in cognitive leisure activities do not appear to be associated with an increased risk of adverse effects compared with those that do not participate.

Implications for research
1 Higher-quality clinical trials such as well-designed randomised controlled trials are required to show a causal relationship between cognitive leisure activities and the risk of AD and other dementias. Because of the nature of this topic it is more suited to longitudinal designs; however, if conducted they must have a sufficient follow-up time and a large sample size.

2 Further investigation into systems that standardise the classification of leisure activities to ensure studies can be compared is warranted.

3 Individual activities should be explored to ascertain whether certain activities are more effective than others and more comprehensive detail in terms of intensity, frequency and the cognitive components used in each activity is required.

4 More research should be conducted to assess both current and past participation in cognitive leisure activities to ascertain patterns of activity participation.

References


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**Appendix I**

**JBI critical appraisal form for comparable cohort/case–control designs**

1. Is sample representative of patients in the population as a whole?
   - Yes
   - No
   - Unclear

2. Are the patients at similar point in the course of their condition/illness?
   - Yes
   - No
   - Unclear

3. Has bias been minimised in relation to selection of cases and controls?
   - Yes
   - No
   - Unclear

4. Are confounding factors identified and strategies to deal with them stated?
   - Yes
   - No
   - Unclear

5. Are outcomes assessed using objective criteria?
   - Yes
   - No
   - Unclear

6. Was follow up carried out over a sufficient time period?
   - Yes
   - No
   - Unclear

7. Were the outcomes of people who withdrew described and included in the analysis?
   - Yes
   - No
   - Unclear

8. Were the outcomes measured in a reliable way?
   - Yes
   - No
   - Unclear

9. Was appropriate statistical analysis used?
   - Yes
   - No
   - Unclear

Include

Reason: ______________________________________