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Activities Outside of the Care Setting for People with Dementia: A Systematic Review

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3 **Title:** Activities Outside of the Care Setting for People with Dementia: A Systematic Review
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ABSTRACT

Objectives To summarise the evidence from interventions investigating the effects of out of care setting activities on people with dementia living in residential aged care.

Design Systematic review.

Methods A systematic search of electronic databases (PubMed, PsycINFO, Scopus, Web of Science, and the Cochrane Library) was performed to identify intervention trials published from journal inception to January 2020. Controlled trials, or quasi-experimental trials which measured pre-, post-, or during-intervention outcomes, where the participants were required to leave the care setting to participate in an intervention, were eligible for inclusion. Quality appraisal of the studies was performed following the Cochrane Collaboration's Risk of Bias or Newcastle-Ottawa Scale tools.

Results Of the 4,155 articles screened, eleven articles met the inclusion criteria from nine different studies. The number of participants in the studies ranged from six to 70 people living with dementia and lasted for three weeks up to five months. The interventions were aquatic exercise, wheelchair cycling, art gallery discussion groups, an intergenerational mentorship program, horse riding, walking, and outdoor gardening. Overall, the studies indicated preliminary evidence of psychological, physiological, and physical benefits, and all interventions were feasible to conduct away from the aged care facilities. However, the low number of participants in the studies, the absence of a control group in all but three studies, low adherence, and potential for selection bias, limits the generalisability of the findings.

Conclusions Activities outside of the residential aged care setting are effective at providing a range of benefits for people living with dementia and should be considered by care providers.

PROSPERO registration number CRD42020166518

STRENGTHS AND LIMITATIONS

- To our knowledge, this is the first systematic review to examine the effects of activities outside of the care setting in people with dementia.
- The different types of interventions with quantitative results are summarised, appraised, and their benefits discussed.
- Only nine different interventions, from 11 publications were identified, highlighting a need for more research in this area.

BACKGROUND

A high proportion of people living in residential aged care facilities (RACF) (also known as nursing homes, long-term care, care homes, and assisted living among others) are living with dementia. Generally, people living with dementia in RACF have more progressive dementia and greater physical limitations than those living in the community and often require high levels of care.¹ As such, there is increasing recognition of the importance of providing high-quality, 24 hour care in RACF and dementia care settings. While the quality of care and the care environment is undoubtedly critical to health outcomes, access to meaningful activities and leisure in these settings can enhance physical functioning and cognitive and mental health.² Person-centred care is based on respecting the values and priorities of the person and in RACF as it promotes quality of life, dignity and autonomy. Psychosocial interventions and meaningful activities for people with dementia can form an important part of person-centred care and include engagement with art and music, use of assistive technology, life-story work, and horticultural therapy.²

Previous studies have indicated that psychosocial interventions provide positive effects on mood, apathy, and have the potential to reduce depression in people living in RACF.³ With the exception of horticultural therapy, which typically occurs outdoors but on the premises of a RACF, these activities commonly occur indoors. Several reviews have evaluated the effects of psychosocial

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3 interventions across community and RACF settings which promote beneficial psychological, physical,
4 and cognitive effects.²⁻⁵ However, to our knowledge, there has not been a consolidation of the evidence
5 relating to the effects of participating in meaningful activities outside the RACF setting, on people
6 living with dementia. Although it is established that being outdoors reduces stress and anxiety in people
7 with dementia⁶, safe and regular access to meaningful activities outside of the RACF are typically not
8 possible without assistance from family or care staff.⁷ Many activities enabling older people to find
9 pleasure and meaning, and activities that they engaged in before moving to a RACF, are held outdoors
10 or in the community setting. Therefore, connecting people to their community and the outdoors is
11 becoming an increased focus of aged care models as part of person-centred care principles. Therefore,
12 we systematically examined the literature which tested psychosocial interventions that enabled people
13 living with dementia to leave the care setting to participate in activities outside of the RACF. The
14 findings of this review will provide clarification to the current evidence base, with the aim to determine
15 which interventions are the most effective in promoting well-being in this population as well as identify
16 priority areas for future research.
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32 33 **METHODS**

34 35 36 **Protocol and Registration**

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39 Methods for this systematic review followed the checklist from the Preferred Reporting Items for
40 Systematic Reviews and Meta-Analyses (PRISMA) guidelines.⁸ The review was preregistered on the
41 International Prospective Register of Systematic Reviews (PROSPERO) (CRD42020166518). Patients
42 and the public were not involved in the design, conduct, reporting, or dissemination of this research.
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48 49 **Selection Criteria**

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51 All comparative quantitative intervention studies, excluding case studies, were included. A PICOS
52 (population, intervention, comparator, outcomes, and setting) approach was used to guide the structure
53 of the systematic review:
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- Population: Human participants living in a RACF (also referred to as long term care, nursing home, care home and residential care) with any form of dementia or cognitive impairment.
- Intervention: Controlled trials, or quasi-experimental trials which measured pre-, post-or during-intervention outcomes, where the participants left the RACF setting to participate in the intervention.
- Comparator: Using an active control condition, usual care, or comparing pre- and post-intervention outcomes.
- Outcomes: Any quantitative methods evaluating participant outcomes (directly or indirectly) which measure psychological health and well-being.
- Setting: Participants must be living in a RACF.

Search Strategy

Electronic database searches of PubMed, PsycINFO, Scopus, Web of Science, and the Cochrane Library were performed for articles published from database inception to January 2020. The keyword search was: dement* OR alzheimer* OR "cognitive impairment" AND psychosocial OR non-pharmacological OR "leisure activities" OR "activity program" OR outdoor* OR outside OR horticultur* OR museum OR gallery OR music OR dance OR choir OR cafe OR theatre OR theater OR film OR movie* OR "meaningful activity" OR "occupational therapy" AND "aged care" OR institution* OR "nursing home" OR "long term care" OR "care home" OR "residential care". The reference lists of all included studies, and related existing systematic reviews, were searched for additional relevant articles. The searches were re-run prior to finalisation of the data analysis on the 15th of May, 2020.

Study Selection and Data Extraction

Eligible studies met the following criteria: use a controlled study design, or compared pre- and post-intervention effects; involved human participants of any age living in a RACF with dementia or cognitive impairment, and quantitatively examined the effects of an intervention which required

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3 participants to leave the RACF setting. Studies were excluded if they were epidemiological or
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5 qualitative studies, reviews, abstracts, conference papers or study protocols.
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8 Two authors (N.D. & N.N.) independently performed the searches using Covidence systematic
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10 review software (Veritas Health Innovation, Melbourne, Australia). Following the removal of
11
12 duplicates, articles were excluded based on title and abstract screening using the selection criteria. For
13
14 articles where this was unclear, the article was carried forward into the full-text review. The full-text of
15
16 each article was read and assessed by the same authors, and independently evaluated to determine if all
17
18 selection criteria were met. The authors met to discuss each article, and a third author (S.I.) was present
19
20 to resolve disagreements.
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23 A customised data extraction form was used to enter data from each article by one author (N.D.)
24
25 and cross-checked by a second author (S.I.). This included the aims, study design, description of the
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27 intervention, details of selection criteria (for example: severity of dementia (where applicable), age,
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29 level of care), outcomes and measures, and results. For included studies that used mixed-methods, only
30
31 the quantitative results were presented and discussed. In addition, if studies included people with
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33 dementia living in RACF and in the community, only the data from the participants in RACF were
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35 presented where possible. The results of the included studies were synthesised quantitatively and
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37 qualitatively.
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40 41 **Quality Assessment** 42

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44 Due to the broad inclusion criteria, two risk of bias tools were used independently by two researchers
45
46 (N.D & S.I.). For randomised controlled trials, the Cochrane Collaboration's Risk of Bias tool was
47
48 used.⁹ The criteria for this tool assesses risk of bias for sequence generation, allocation concealment,
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50 blinding of participants, personnel, and outcome assessors, incomplete outcome data, and selective
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52 outcome reporting. For each criterion, studies were assessed for risk of bias as low, unclear, or high.
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54 For non-randomised and quasi-experimental studies, the Newcastle-Ottawa Scale (NOS) for non-
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56 randomised studies was used for the quality assessment.¹⁰ The NOS assesses methodological quality
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58 based on participant selection, comparability of treatment groups, and outcome ascertainment with a
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3 maximum score of nine. Currently, there is no recommended tool to assess quality for quasi-
4 experimental studies with only a treatment group, the highest possible score for these studies was six
5 as previously described.¹¹
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10 RESULTS

11 Study Selection

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16 The systematic review search resulted in 6453 records for screening and 2,308 duplicates were removed.
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18 Ten articles were identified through searching of the reference lists of relevant systematic reviews and
19 included articles. Following title and abstract screening, 173 references remained for full-text review.
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21 In total, 162 records were excluded. In order, the articles were excluded because they failed the inclusion
22 criteria for the following reasons: not published in English (n = 4), not a journal article (conference
23 abstract or not peer reviewed) (n = 12), wrong study design (qualitative study or survey) (n = 11), wrong
24 population (participants not living with dementia, or participants not living in a RACF) (n = 20), and
25 wrong intervention (intervention did not require participants to leave the RACF (n = 114). One study
26 was excluded as we were unable to receive clarification from the authors as to whether participants left
27 the RACF for the intervention. Eleven articles reporting on nine different studies fit the inclusion
28 criteria.¹²⁻²² The PRIMSA flow chart is presented in Figure 1. A meta-analysis was not performed due
29 to the diversity of the included interventions and the reported outcome measures.
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42 Study Characteristics

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45 Of the eleven included articles¹²⁻²², four reported on two different studies. Therefore, nine total studies
46 were included. The nine studies reported on data from a total of 177 participants living in RACF from
47 high-income countries, Australia^{14 17-21}, the United States^{12 13 15 16}, and Sweden.²² (Table 1). Study
48 sample sizes ranged from six¹⁵ to 70.¹³ Two studies were randomised controlled trials^{12 13 16}, one study
49 was a controlled trial¹⁷, and the remaining six studies used quasi-experimental designs.^{14 15 18-22} The
50 participants ranged in age from 77.0¹⁹ to 88.4 years.^{18 21}
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58 Interventions

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3 Three of the articles included people living with dementia participating in a swimming-based program
4 at a local pool.^{17 18 21} Two of these articles were from the same pilot study.^{18 21} Two articles were from
5 one study of a recreational program which included wheelchair cycling.^{12 13} Two studies were of arts-
6 based discussion at an art gallery.^{14 20} The remaining studies were horse riding (equine-assisted
7 activities)¹⁵, mentorship visits as part of an intergenerational program¹⁶, gardening at a park adjacent to
8 the RACF²², and supervised walks in the community.¹⁹ The duration of the interventions lasted from
9 two weeks¹² to five months.¹⁶
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17 **Outcome Measures**

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21 Four articles assessed behavioural and psychological symptoms including agitation.^{12 13 17 21} Four
22 articles assessed depressive symptoms.^{13 14 16 17} Four articles assessed physical function^{14 17 18 22}, and
23 one study evaluated quantitative characteristics surrounding walks outside of the RACF including the
24 number of walks taken, and reasons for walks not proceeding.¹⁹ Two studies each assessed cognitive
25 function^{14 16}, and anxiety.^{16 17} One study assessed cognitive function at baseline to determine if it
26 affected participation in gardening activities.²² One article assessed self-reported quality of life¹⁴, and
27 one used an observer-rated QoL instrument.¹⁵ One article each assessed changes in the number of sleep
28 disturbances¹³, physiological outcomes (salivary cortisol and interleukin-6)¹⁴, and activities of daily
29 living.¹⁷ During the intervention, four articles assessed changes in activity participation and
30 engagement^{12 13 15 20}, and one article rated well-being.¹⁴
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43 **Quality Assessment**

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46 The selection criteria allowed the inclusion of randomised, non-randomised studies, and quasi-
47 experimental studies. Therefore, the included studies were mostly preliminary by study design and did
48 not represent conclusive evidence of the efficacy of the interventions. Two randomised controlled trials
49 were evaluated using the Cochrane risk of bias tool.^{12 13 16} Two publications (one study) about
50 wheelchair cycling were rated as most unclear, and high risk of bias for allocation concealment.^{12 13} The
51 wheelchair cycling studies, and the study by George et al. (2011) were rated with high risk of bias for
52 blinding of personnel and participants.^{12 13 16} However, the study by George et al. (2011) was rated low
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3 or unclear for the other criteria. The remaining studies were assessed using the Newcastle-Ottawa
4 Quality Assessment for non-randomised studies. Only the study by Henwood et al. (2017) was scored
5 out of nine due to the presence of a control group (8/9).¹⁷ The six other studies were of good quality
6 (4/6 – 5/6).^{14 15 18-22} All six of these studies received a score of zero for “Outcome assessment” as they
7 were not independent blind assessments. Two studies did not recruit representative samples.^{15 22} The
8 study by Fields et al. (2018) recruited participants with horse riding experience¹⁵, and the study by
9 Thelander et al. (2008) selected participants with a documented history of agitated or restless behavior.²²
10 The first swimming study lost greater than 25% of participants due to attrition and was rated zero in the
11 “Adequate cohort follow-up category”.^{18 21}

22 23 **Narrative Synthesis of Intervention Effects**

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25 Three articles from two studies by the same research team, investigated the effects of twice weekly
26 participation in the Watermemories Swimming Club.^{17 18 21} The program aimed to create positive
27 memories in people who previously enjoyed swimming. The pilot study results were reported in two
28 publications by Neville et al. (2014) and Henwood et al. (2015) with eleven people with dementia
29 recruited from two RACF.^{18 21} The twelve-week intervention incorporated supervised aquatic exercise
30 at a local municipal pool and was designed to promote physical and functional ability. The study by
31 Neville et al. (2014) reported outcome measures of psychological well-being.²¹ The Psychological
32 Well-Being in Cognitively Impaired Persons Scale (PW-BCIP) and the Revised Memory and Behaviour
33 Problems Checklist (RMBPC) were used to assess positive and negative affective states and
34 engagement, and behaviour, agitation and depression (BPSD), respectively. Data were collected at
35 baseline, week six, week nine, and post-intervention. Across time points, improvements were observed
36 in the PW-BCIP (n = 8; p = 0.034), RMBPC (BPSD frequency) and RMBPC (staff reaction to BPSD)
37 (both; n = 10; p = 0.001). The study by Henwood et al. (2015) focused on physical and functional
38 benefits of the Watermemories Swimming Club.¹⁸ The outcome measures were hand grip muscle
39 strength and body composition, with balance and functional capacity measured by two composite
40 measures, the Balance Outcome Measure for Elder Rehabilitation (BOOMER) and the Short Physical
41 Performance Battery (SPPB). Of the ten participants who provided data, an improvement in left hand
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3 grip strength was observed ($p = 0.017$). Both positive and negative non-significant trends were observed
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5 for other outcomes. However, transportation of people with dementia from the RACF to a swimming
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7 pool was considered feasible and set the foundation for the controlled trial by Henwood et al. (2017).¹⁷
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9 This study was also a twelve-week intervention, but included a control group. The outcome measures
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11 were the same as the pilot study^{18 21}, but also included the Cornell Scale for Depression in Dementia
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13 (CSDD), Geriatric Anxiety Inventory (GAI), KATZ Activities of Daily Living Scale, and sarcopenia
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15 status using the European Working Group in Older People (EWGSOP) criteria. Of the two RACF
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17 involved in this study, one had considerably better compliance (87.5% vs 44.6%). The analytic sample
18
19 consisted of nine participants in both the intervention and control groups. Both groups had a decrease
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21 in Skeletal Mass Index (SMI) and lean mass post-intervention ($p = 0.002$; $p = 0.001$, respectively). A
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23 significant group by time interaction was observed for left- and right-hand grip strength ($p = 0.017$; $p =$
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25 0.003 , respectively), driven by large decreases in the control group ($p \leq 0.026$). Sarcopenia prevalence
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27 was increased post-intervention in both groups compared to baseline, increasing from four to six
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29 participants in the intervention group ($p = 0.038$) and from one to all nine participants in the control
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31 group ($p = 0.002$). Greater improvements were observed in the intervention group in the behavioural
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33 and psychological outcomes and activities of daily living, but these were non-significant (all, $p > 0.05$).
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35 Overall, the results of these studies reveal that away from the RACF, swimming is feasible, although
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37 both studies had participant attrition.
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42 Wheelchair Cycling was the intervention in two articles from one study of recreational therapy
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44 activities.^{12 13} In this activity, people with dementia and depressive symptoms sat in a wheelchair
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46 attached to a half bicycle and receive a 15-minute ride where conversation with the cyclist was
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48 encouraged. An intensive two- week program with daily rides on the weekdays was first implemented
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50 with 41 and 29 participants from two RACF (total, $n = 70$). This was followed by a ten-week
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52 maintenance period where each participant went for a ride twice per week. The primary outcome in the
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54 first study was change in depressive symptoms assessed using the Geriatric Depression Scale (Short-
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56 form).¹³ The intervention group had reduced depressive symptoms between baseline and after the
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58 intensive two-week program ($p < 0.001$) and between baseline and after the ten-week maintenance
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3 program ($p < 0.001$). Depressive symptoms in the control group increased between baseline and by the
4 end of the intensive two-week program ($p = 0.047$). Sleep disturbances were also recorded in one of the
5 RACF participating in the study ($n = 41$). At baseline, sleep disturbances were reported in five
6 participants in the intervention group and four in the control group. After the intensive two-week
7 program, sleep disturbances were reported in two people in the treatment group and nine in the control
8 group ($p < 0.001$). Activity participation increased in the intervention group between baseline and
9 following the intensive two-week program ($p < 0.001$), and in the maintenance program ($p < 0.001$).
10 Between baseline and the end of the maintenance program, the control group were participating in fewer
11 activities ($p = 0.016$). The second study compared the amounts of encouragement and engagement,
12 agitation, and mood levels in a sub-sample of 54 participants who received the wheelchair biking during
13 the intensive two-week program with the 72 other recreational activities that were carried out over the
14 two weeks.¹² These activities included playing cards, painting, music, pet therapy, and walking.
15 Participants spent longer participating in wheelchair cycling ($p < 0.001$). Less encouragement, higher
16 mood, lower agitation, and greater engagement were all observed for wheelchair cycling compared to
17 the other activities. Only the effect for engagement was statistically significant ($p < 0.001$). The results
18 of these two studies demonstrated benefits from being outside participating in wheelchair cycling in
19 people with dementia and depression in RACF's.

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41 Two studies of the National Gallery of Australia Art and Dementia program met the inclusion
42 criteria.^{14 20} In both studies, each with an intervention period of six weeks, participants who were living
43 in RACF were transported to the art gallery by bus and were accompanied by care staff. Most
44 participants were recruited because care staff believed they would benefit from the program. The Art
45 and Dementia program at the National Gallery of Australia is similar to the program pioneered by the
46 Museum of Modern Art in New York City.²³ Typically, participants discuss and engage with artworks
47 from the galleries collection during a one hour pre-planned tour. The study by MacPherson et al. (2009)
48 recruited 15 people living with dementia, eight from a single RACF.²⁰ Prior to the study, participants
49 were reported to manifest significant challenging behaviours in their daily life. Observer-rated video
50 analysis of the week one and five visits to the art gallery revealed an increase in observations coded as
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3 “very engaged” ($p = 0.03$). Two to three weeks after the final visit, one participant was able to clearly
4 remember the program, while others remembered aspects when prompted, and two did not remember.
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6 The study by D’Cunha et al. (2019) at the same art gallery recruited 28 participants and 25 completed
7
8 pre- and post-intervention, and follow-up outcome measures (quality of life, depressive symptoms, and
9
10 cognitive performance).¹⁴ Of the 25 participants, 22 were living full time in a RACF. Improvements
11
12 were observed in each of the outcomes (all p ’s < 0.05), except for proxy-rated quality of life ($p = 0.076$).
13
14 Unique to the literature on art gallery programs for people living with dementia, this study also
15
16 evaluated changes in salivary cortisol and interleukin-6 ($n = 22$), and hand grip strength. The waking to
17
18 evening salivary cortisol ratio improve between pre- and post-intervention ($p = 0.033$), indicating a
19
20 more dynamic diurnal cortisol rhythm in response to the intervention. In both studies, engagement was
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22 high for all participants throughout both six-week periods. Together, these studies highlight that it is
23
24 feasible to transport people living with dementia to local galleries and museums, and that specifically
25
26 tailored programming has a range of benefits. However, notably, both studies were lacking control
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28 groups and participants were selected based on their likelihood to enjoy and derive benefits from the
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30 program.
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36 The longest included study was a randomised controlled trial of a five month intergenerational
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38 mentorship program which included 15 people living with dementia and students at an intergenerational
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40 school.¹⁶ The school was one of the first educational programs to enable people living with dementia to
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42 provide mentorship to younger people in a structured voluntary role. Over the five months, the
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44 participants alternated between one hour visits to a kindergarten and a sixth grade classroom for a total
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46 of 20 hours. In each class, a participant worked with two to three students and engaged in intergeneration
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48 life-history reminiscence sessions. The control group engaged in a peer education seminar titled
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50 “Successful Aging: Reclaiming Elderhood” and received take home assignments so the time
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52 commitment was equal to the intervention group. The results indicated decreased anxiety and stress in
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54 the intervention group and an increase in the control group ($p = 0.049$). Despite the small sample size,
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56 this finding supports intergenerational volunteering as a meaningful activity to promote quality of life
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3 for people living with dementia which may also help to reduce stigma of dementia through engagement
4 with children.
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8 The study by Field et al. (2018) investigated associations between nine different activities, one
9 being horse riding (equine-assisted activities) at a therapeutic riding centre.¹⁵ Eight people with mild-
10 moderate stage dementia and previous experience with horses were recruited from a single RACF;
11 however, only six participants met criteria to be included in the analysis. The effects of horse riding
12 were compared to a range of activities at the RACF including watching television, games, music, during
13 meals, and physical therapy. A modified version of the Activity in Context and Time observational
14 instrument was used to evaluate environment correlates of quality of life, and specific indicators related
15 to agitation and apparent affect, with the latter derived from the Apparent Affect Rating Scale. Trained
16 researchers used a hand-held computer to record observations using an instantaneous sampling strategy
17 at ten minute intervals for four hours twice per week for eight weeks. The participants travelled by bus
18 to the riding facility each week for eight weeks for the therapeutic horse riding intervention and were
19 given the choice of riding, grooming, petting or observing the horses while being guided by volunteers.
20 Levels of conversation ($p < 0.001$) and apparent affect ($p = 0.001$) were improved in horse riding
21 compared to the other activities. The ability of the participants to converse, maintain their gaze, show
22 pleasure, and participate in complex activities were more frequently observed in the horse riding
23 activity. Based on this small study, horse riding is considered a safe and enjoyable activity to promote
24 quality of life of people with dementia living in RACF.
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45 A Safe Walking Program was investigated by MacAndrew et al. (2019) in seven people with
46 severe dementia who were prone to high intensity wandering from two RACF.¹⁹ The three-week
47 intervention involved supervised walks outside the RACF each weekday. The timing of the intervention
48 was calculated to be 30 minutes before when the participants were most likely to wander (between 7
49 am and 7 pm) as determined using Actigraph™ activity monitoring. The walks were facilitated by one
50 trained “interventionist” around the predetermined routes in the immediate neighbourhood of the
51 RACFs. Each “interventionist” followed a set protocol fidelity checklist which was completed at the
52 end of each walk and served as the quantitative outcome measure. The checklist included the pre-walk
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3 preparation activities, the time and duration of the walk (30 minutes), whether the prescribed route was
4 followed, and any deviations to the protocol. In total, 86 of the 105 (80%) planned walks were
5 completed according to the protocol fidelity checklist for an average of 12.3 walks per participant out
6 of 15. Ninety-one percent of the walks lasted for the full 30 minutes. The Safe Walking Program was
7 found to be practically feasible and perceived to have benefits for people with dementia who wander.
8 After the study, staff reported that some participants seemed to walk with more purpose and were more
9 likely to be attracted to areas where group activities were occurring.
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19 Outdoor gardening was the intervention in the study by Thelander et al. (2008).²² Eight residents
20 of a RACF were recruited for 40-70 minute gardening sessions, three time per week over a six-week
21 period, in groups of two or three participants. Five of the participants used a walking frame. The
22 gardening took place in a park adjacent to the RACF, and activities focused on park maintenance
23 including tidying gravel paths, weeding, composting, and planting flowers, although there was
24 flexibility to perform other tasks within the participants physical capabilities. Participants were
25 observed and rated using a “Six-degree independence scale” designed specifically for this study which
26 evaluated the levels of assistance required to perform the activities from independent to not participating
27 in activities. Generally, there were no fluctuations between residents’ independence across the
28 intervention, and each resident participated between 10-15 times and rated between two (carried out
29 activity with supervision) and five (extensive need for help). Baseline score on the MMSE had no
30 significant effect on level of independence ($p = 0.50$), although more help was required in participants
31 with more severe dementia. The study demonstrated that people with dementia living in a RACF can
32 be safely enabled to participate in gardening activities which have the potential to improve physical and
33 functional capacity in small supervised groups.
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50 51 **DISCUSSION**

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54 There is a need for engaging activities that are enjoyable and enable social connection for people living
55 with dementia in RACF. To our knowledge, this is the first systematic review to collate the results of
56 all studies which facilitated participation in activities within the community for people with dementia
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3 living in RACFs to leave their facility as part of an intervention. Studies of wheelchair cycling,
4 swimming, art gallery visits, intergenerational mentorship, horse riding, walking, and outdoor
5 gardening were identified. However, due to a paucity of studies, we could not determine which
6 interventions are the most effective in promoting well-being. Each study focused on different outcomes
7 however, it was demonstrated that activities outside the care setting were feasible and had the potential
8 to offer psychological and physical benefits to people living with dementia. Overall, there was an
9 absence of randomised controlled trials and no blinded studies. This may be due to several factors
10 including practical difficulties in performing large blinded studies in RACF settings, the cost to
11 undertake this research, and the need for RACF staff to be present in order to ensure the safety of the
12 participants. The findings of the present study identify a need for further research into how these
13 activities can be sustainably and adequately implemented for people with dementia in the RACF setting.
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26 27 *Psychological outcomes*

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29 Most of the studies in this review included a psychological outcome, and demonstrated the potential for
30 improvements in well-being^{12-14 21}, quality of life¹⁴, mood^{12 13 15}, cognition¹⁴, and reducing depression¹²⁻¹⁴
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16 and behavioural symptoms.^{19 21} People with dementia in RACF are relatively high users of
psychotropic agents²⁴; however, psychosocial approaches may lead to a decrease in use and benefit
mental health and well-being.^{25 26} Visiting an art gallery was shown to be beneficial in two studies^{14 20},
and a range of cultural and arts-based activities have been considered to have greater benefits than
pharmacological treatments as they promote social functioning and can facilitate meaningful personal
experiences.²⁷ Similarly, exercise, as shown in this review through walking, swimming, gardening, and
horse riding, has positive effects on cognitive performance, and can reduce depression and anxiety.²⁸
Being outdoors as a passenger in wheelchair cycling also has psychological benefits by providing access
to fresh air, promoting conversation, memory formation, and relaxation.^{12 13 29} All included studies
facilitated social connectedness as the activities were performed in small groups or with others. This
was seen in the study of gardening where participants worked together to perform a civic duty.²²
Gardening and horticultural therapy have been shown to have positive psychological, social and
physical benefits, and benefits are compounded when undertaken in groups.³⁰ Interestingly, in the study

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3 by MacAndrew et al. (2019), staff found that the walking program enriched the lives of the participants,
4 who were selected due to their wandering, and even created positive change in the walking and
5 wandering habits of some participants.¹⁹ While dementia is a cluster of incurable conditions, social
6 participation and engaging in activities away from the RACF has the potential to prolong quality of life
7 and potentially reduce behavioural symptoms in the care setting.
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13 *Physical outcomes*

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17 Swimming, gardening, horse riding, and walking were physical activities used in the included studies.
18 In particular, physical benefits, in the form of grip strength and a reduction in sleep disturbances were
19 observed as a result of the swimming^{17 18} and wheelchair cycling^{12 13}. Grip strength is a widely used
20 marker of whole body muscular strength which is associated with vitality, physical function, and
21 cognitive performance.^{31 32} Swimming improved grip strength^{17 18}, but no benefits were observed for
22 grip strength following six weeks of arts-based discussion groups¹⁴, suggesting that physical activity is
23 required to see improvements. Swimming for older people has many benefits including an increase in
24 metabolism which can help with sleep and appetite, in addition to being a non-weight bearing form of
25 physical activity which enables a full range of motion and joint mobility. A reduction in sleep
26 disturbances was observed in response to wheelchair cycling.^{12 13} Individualised social activities have
27 been shown to improve sleep drive and the circadian rhythm in people with dementia, and reduce
28 daytime sleepiness.³³ It has also been demonstrated that multi-component interventions and light
29 therapy can improve sleep quality.³⁴ While sleep outcomes were not assessed in the outdoor gardening
30 study by Thelander et al. (2008), therapeutic gardens may also improve sleep-wake cycles of people
31 with dementia.³⁵ Benefits can be observed from simply getting outdoors to receive increased exposure
32 to natural sunlight.³⁶ Gardening at a local park, and walking represent ideal opportunities for people
33 with dementia to engage in physical activity in an outdoor environment.^{19 29} The use of gardens and
34 green spaces in the community represents an enabling environment for people with dementia where
35 they can engage in meaningful activity and achieve a sense of contribution and connection with their
36 community.³⁷ In the broader literature, the highest quality evidence for physical interventions in
37 dementia such as strength training and aerobic exercise, included a social aspect,² and it is possible that
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3 the physical interventions identified in this review (swimming, walking, gardening, and horse riding)
4 may result in more benefits because they also involved this social aspect and took place within the
5 community setting.
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10 *Physiological outcomes*

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13 The assessment of the physiological markers in psychosocial interventions for people with dementia is
14 a relatively new and emerging area of research.³⁸ The study by D’Cunha et al. (2019) found an
15 improvement in the diurnal cortisol rhythm after participating in arts-based discussion groups over six
16 weeks.¹⁴ Cortisol is the bodies primary stress and awakening hormone, and impairments in the diurnal
17 rhythm in dementia are associated with lower hippocampal volume, increased agitation, decreased
18 resiliency, and greater cognitive impairment, and is associated with depression.^{14 39} Improvements in
19 skeletal muscle mass and lean body mass were observed after participation in the Watermemories
20 swimming club.^{17 18} Importantly, improvements in muscle mass in older people may have implications
21 for falls prevention, and swimming can potentially improve balance, gait, and functional status.⁴⁰ The
22 measurement of physiological responses such as stress hormones levels, skin responses, and heart rate
23 variability, have been associated with well-being and mental health in dementia and are likely to be
24 improved following activities outside of the RACF.³⁸
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39 The capacity to facilitate meaningful activities outside the care setting may require planning
40 and resources beyond that needed for activities within the care settings. This includes the availability
41 of adequate staff, suitable transportation, assessing the physical abilities and needs of the residents and
42 the suitability of the activity itself. For activities to provide benefits, the findings from this review
43 demonstrate that they do not necessarily require additional expenses or even travel, with the wheelchair
44 cycling^{12 13}, walking¹⁹, and gardening²² studies taking place within close proximity to the RACF, making
45 them practical and accessible for care staff and people with dementia. The studies that involved art
46 gallery visits^{14 20}, horse riding¹⁵, and swimming^{17 18 21} required the participants to travel to participate in
47 the activity which requires suitable transport and adequate storage space for mobility equipment and
48 care staff or volunteers. None of the included studies detailed how the travel occurred, but all indicated
49 that they incorporated volunteers or researchers in addition to regular staff. Safety of the residents is an
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3 important consideration in the feasibility of using spaces outside a RACF, and the need for supervision
4 can restrict potential feelings of autonomy.⁷ For example, in the gardening study, the participants
5 required supervision and there was difficulty in caring for the participants at the same time even though
6 group sizes were limited to two or three.²² The size of the RACF, and the number of residents, are also
7 factors in the potential for community-based activities to occur.⁴¹ Despite these potential barriers,
8 activities in the community should be encouraged and are free or low-cost and can be enjoyed by people
9 with dementia. It is important to weigh up the benefits of activities outside the RACF with the risks,
10 and ensuring that people with dementia have the right to choose whether they want to take some risk to
11 engage in meaningful activities.⁴²

22 **Limitations**

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25 The weakness of the included studies was primarily seen in their study design. Only two studies were
26 performed in a randomised controlled fashion and did not perform any blinding^{12 13 16}, and one study
27 was a controlled trial without randomisation.¹⁷ The remainder of the studies were limited by their quasi-
28 experimental design.^{14 15 18-22} Quasi-experimental, non-randomised studies aim to stimulate and inform
29 more rigorous interventional research, and if well-conducted, can provide evidence for causal
30 inference.⁴³ Overall, limited conclusions can be made based on the included studies due to their sample
31 sizes and preliminary nature. However, evidence supporting psychosocial interventions for people with
32 dementia are inherently difficult to conduct, may have challenges associated with recruitment and
33 informed consent, and may place additional demands on staff or carers. Accordingly, this form of
34 evidence is often the best available and can help inform the implementation of low risk activities and
35 interventions in the care setting. Moreover, if there is evidence that participation in an activity can
36 provide even a modest benefit then it should be encouraged. We are also limited by the lack of quality
37 assessment tools that are tailored to use to evaluate the included studies, particularly for the quasi-
38 experiment studies as there is not one recommended tool for appraisal.

55 **Future Directions**

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3 While field trips and outings frequently occur at many RACF, there is a need for more well-funded and
4 adequately designed research to identify and overcome the barriers to implementation to enable greater
5 participation in the community for people with dementia. The logistics and cost of transporting groups
6 of older people and people with dementia represents a possible barrier, and research and policy work
7 are required to determine how to maximise opportunities for people with dementia to participate safely
8 in the community. Given that transportation represents a barrier to participation, future research should
9 also investigate the potential to use a variety of public and community transport options, which may
10 also include ride-sharing and autonomous vehicles as a potentially safe method of transportation for
11 people with dementia. There is also a need for systems to be in place to best utilise existing public
12 spaces, such as art galleries and museums and even local parks. One of the most significant effects of
13 engaging in activities outside of the RACF is a reduction in falls; however, this outcome was not
14 assessed in any of the included studies. As reduction in the likelihood of falls can reduce morbidity and
15 mortality, prospective studies are needed to determine if dementia-specific activities outside of the
16 RACF can reduce risk. Outside activities are not suitable for all people with dementia in RACF with
17 physical limitations or more progressed cognitive decline. Therefore, future research should investigate
18 how meaningful activities can be experienced in novel ways, for example through virtual reality
19 technology which can potentially provide people living in RACF the sensation of being outside and
20 provide opportunity for physical activity through exergaming.⁴⁴

41 **CONCLUSION**

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45 The findings of this systematic review demonstrate that there is currently limited, preliminary evidence
46 from interventions which enable people with dementia to engage in activities outside of the RACF
47 setting. The results suggest that activities outside of the RACF is associated with improvements in
48 psychological and physical health. The interventions in this review included a variety of activities with
49 varying degrees of accessibility. In order for greater participation in community, activities and programs
50 to be achieved for people with dementia, future studies are needed to overcome barriers to
51 implementation in the RACF setting.
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Contributions

NMD conceived and designed the study, performed the searches and article screening, carried out the data extraction and quality assessment, analysis and drafted the manuscript. SI helped design the study, carried out of the quality assessment, and commented on the manuscript. JK and AJM provided critical analysis on the manuscript. NN helped conceive and design the study, performed the searches and article screening, and commented on the manuscript.

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Competing interests

All authors report no disclosures.

Patient consent

Not required.

Data sharing statement

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35 <https://doi.org/10.1016/j.healthpol.2014.10.006>
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37 44. D'Cunha NM, Nguyen D, Naumovski N, et al. A Mini-Review of Virtual Reality-Based
38 Interventions to Promote Well-Being for People Living with Dementia and Mild Cognitive
39 Impairment. *Gerontology* 2019;**65**(4):430-40. doi: 10.1159/000500040 [published Online
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60 First: 2019/05/21]

Figures

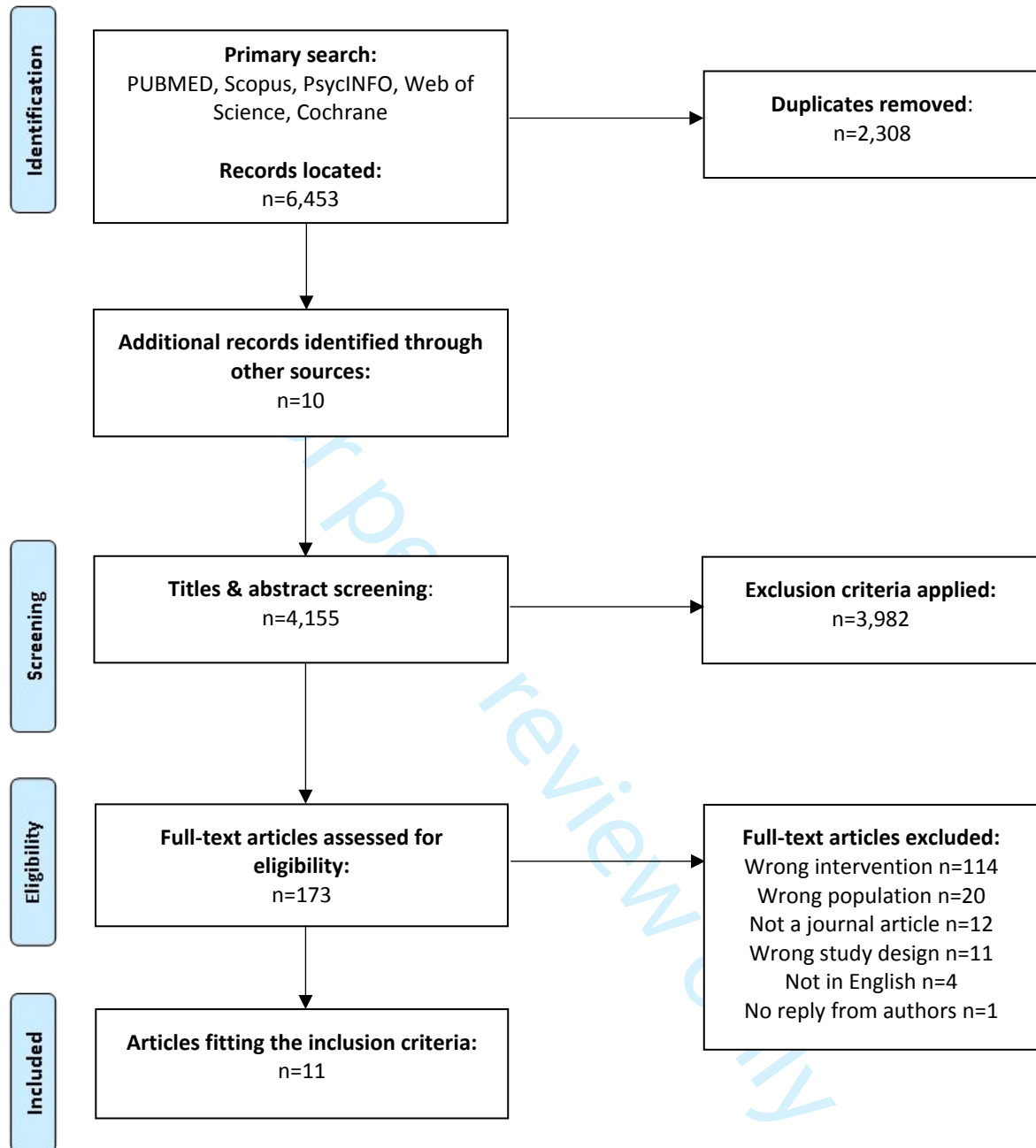


Figure 1. PRISMA flow chart summary of systematic review search process.

Tables

Table 1.

Reference	Intervention	Methods	Participants	Outcome Measures	Results
Buettner & Fitzsimmons (2002) United States	Wheelchair cycling in two phases: 1. Small group discussions & 15-minute ride 5 times per week for 2 weeks, 2. Twice per week maintenance program to attend activities for 10 weeks.	RCT with data collection at pre, post phase 1, and post phase 2.	70 with dementia and depression, MMSE \leq 24, GDS-SF \geq 4, living in skilled nursing and assisted living. Age = Not reported.	GDS-SF, CMAI, sleep disturbances, activity participation.	Intervention group has lower depressive symptoms after phase 1 and between pre and phase 2 (both p's < 0.0001). No effect on CMAI. Sleep disturbances were improved in intervention group between pre and phase 1 (p < 0.0001). Activity participation improved in treatment group between pre and phase 1 & 2 (both p's < 0.001), and decreased in control between pre and phase 2 (p = 0.016).

<p>Buettner et al. (2013) United States</p>	<p>Two weeks (weekdays only) of individualised recreational therapy based on functional abilities (wheelchair cycling, painting, music, cooking, pet therapy, walking, and playing cards).</p>	<p>Sub-analysis of RCT with data collection at pre and post-intervention. Wheelchair cycling was compared to all other interventions.</p>	<p>54 with dementia and depression, MMSE \leq 24, GDS-SF \geq 4, living in skilled nursing and assisted living. Age = 86.1 years.</p>	<p>Engagement levels, minutes on task, and encouragement required.</p>	<p>Engagement was higher during wheelchair cycling compared with all other interventions ($p < 0.001$). Wheelchair cycling participants had a more positive mood, less agitation, and required less encouragement.</p>
<p>D’Cunha et al. (2019) Australia</p>	<p>Weekly visits for 6 weeks to a local art gallery for art based discussion in groups of 5-6. Trained educators delivered the intervention.</p>	<p>Quasi-experimental: Data collection at pre, post, follow-up.</p>	<p>25 with mild to severe dementia from five RACF (1 person from community). 22 provided biological samples. Age = 84.7 ± 7.27 years.</p>	<p>Pre, Post: Salivary cortisol, Interleukin-6, M-ACE, DEMQOL, DEMQOL-Carer, GDS-SF, Hand grip strength, GWQ.</p>	<p>Improvement in waking to evening salivary cortisol ratio ($p = 0.033$), DEMQOL ($p < 0.001$), GDS-SF ($p = 0.015$), immediate recall ($p = 0.009$), and verbal fluency ($p = 0.027$).</p>

					GWQ improved from visit 1 to 6 (p = 0.033).
Fields et al. (2018) United States	Weekly visits for 8 weeks to an equine-assisted activities program at a non-profit therapeutic riding centre.	Quasi-experimental: Intervention compared with all other RACF activities.	6 with moderate dementia from a RACF with previous experience with horses. Age = 83.3 years.	Real-time observations using modified version of Activity in Context and Time QoL indicator instrument	More positive responses in conservation (p < 0.001) and apparent affect (p = 0.001) in intervention compared with other activities.
Henwood et al. (2015) Australia	Twice weekly exercise sessions for 12 weeks at Watermemories Swimming Club with a trained swimming instructor and in-pool support from staff or carers.	Quasi-experimental: Data collection at pre and post.	10 people with dementia from 2 RACF. Age = 88.4 years.	BMI, Body composition, SPPB, BOOMER, Hand grip strength.	Left hand grip strength improved (p = 0.017).

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<p>Henwood et al. (2017) Australia</p>	<p>Twice weekly exercise sessions for 12 weeks at Watermemories Swimming Club with a trained swimming instructor and in-pool support from staff or nursing students.</p>	<p>Controlled trial.</p>	<p>18 people with dementia from 7 RACF. Age = 82.4 ± 6.6 years.</p>	<p>BMI, Body composition, SPPB, BOOMER, Sarcopenic status, Hand grip strength, KATZ, RMBPC, PWB-CIT, CSDD, GAI.</p>	<p>Skeletal muscle index (p = 0.002) and lean mass (p = 0.001) decreased in both groups, and hand grip strength decreased in the control group (p ≤ 0.026). Improvements in intervention group approached significance for RMBPC (p = 0.06).</p>
<p>George & Singer. (2011) United States</p>	<p>Alternating weekly mentorship visits with a kindergarten and 6th grade classroom for 5 months.</p>	<p>RCT.</p>	<p>15 people with dementia from one RACF (8 in intervention, 7 in control). Age = 85.7 (Intervention), 81.4 (Control).</p>	<p>MMSE, BAI, BDI, single questions (sense of purpose, sense of usefulness).</p>	<p>BAI decreased in intervention group and increased in control group (p = 0.049).</p>

MacAndrew et al. (2019) Australia	Each weekday for 3 weeks, residents were taken on a 30-minute supervised walk into the community outside the RACF.	Quasi-experimental: data collected surrounding each walk.	7 people with severe dementia from two RACF. Age = 77.0 years.	Feasibility data were collected as the percentage of congruence between walks according to pre-defined checklist.	Of 105 planned walks, 80% (n = 86) were completed. 91% of the walks lasted 30 minutes. Fatigue, pain, and desire to return were the most common reasons for walks not proceeding.
MacPherson et al. (2009) Australia	Weekly visits for 6 weeks to a local art gallery for art based discussion in groups of 5-6. Trained educators delivered the intervention.	Quasi-experimental: data collection at weeks 1 and 5.	8 people with moderate to severe dementia from two RACF. Age = 86.6 years.	Observer-rated video behavioural analysis at weeks 1 and 5.	Observations coded as “very engaged” increased between timepoints (p = 0.03).
Neville et al. (2014) Australia	Twice weekly exercise sessions for 12 weeks (with 2 week break) at Watermemories Swimming	Quasi-experimental: data collection at	10 people with dementia from 2 RACF. Age = 88.4 years.	RMBPC, PWB-CIP	Psychological well-being was different across timepoints (p = 0.034), increasing between

	Club with a trained swimming instructor and in-pool support from staff and friends or family.	baseline, weeks 6, 9, and post.			baseline and week 9, and declining at post-intervention. Fewer BPSD between baseline and weeks 6 and 9 in both frequency and distress to staff (both p's = 0.001).
Thelander et al. (2008) Sweden	Gardening activities in an adjacent park to the RACF for six weeks, three times per week.	Quasi-experimental: observations after each session.	8 people with dementia from one RACF. Age = 86.8 years.	Observations using six-degree independence scale assessing level of independent activities. MMSE performed at baseline.	Independence scale results ranged from 2 to 5. MMSE results had no influence on independence (p = 0.50).

Key: BOOMER: Balance outcome measure for elder rehabilitation, BMI: Body mass index, BPSD: Behavioural and psychological symptoms of dementia; CMAI: Cohen-Mansfield Agitation Inventory, CSDD: Cornell scale for depression in dementia, DEMQOL: Health-related quality of life (dementia), GAI: Geriatric anxiety inventory, GDS-SF: Geriatric depression scale (short-form), GWQ: General Wellbeing Questionnaire, KATZ: KATZ Index of independence in activities of daily living, M-ACE: Mini-Addenbrookes Cognitive Examination, MMSE: Mini-mental State Examination, PWB-CIB: Psychological well-

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3 being in cognitively impaired persons, RACF: Residential aged care facility, RMBPC: Revised memory and behavioural problem checklist, SPPB: Short
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5 physical performance battery.
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Table 2. Quality assessment of included randomised studies.

	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias
Buettner et al. (2002) & Buettner et al. (2013)	Unclear	High	High	Unclear	Unclear	Unclear	Unclear
George et al. (2011)	Low	Unclear	High	Unclear	Low	Low	Unclear

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Table 3. Quality assessment of included non-randomised studies

Study	SELECTION				COMPARABILITY	OUTCOME			Overall Score
	Representativeness of cohort	Selection of non-exposed cohort	Exposure ascertainment	Demonstrate that outcome not present at study start	Comparability of cohorts	Outcome assessment	Adequate follow-up for outcomes to occur	Adequate cohort follow-up (< 25% attrition)	
D’Cunha et al. (2019)	1	N/A	1	1	N/A	0	1	1	5/6
Fields et al. (2018)	0	N/A	1	1	N/A	0	1	1	4/6
Henwood et al. (2015) & Neville et al. (2014)	1	N/A	1	1	N/A	0	1	0	4/6
Henwood et al. (2017)	1	1	1	1	1	0	1	1	8/9

MacAndrew et al. (2019)	1	N/A	1	1	N/A	0	1	1	5/6
MacPherson et al. (2009)	1	N/A	1	1	N/A	0	1	1	5/6
Thelander et al. (2008)	0	N/A	1	1	N/A	0	1	1	4/6

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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3-4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4-5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5-6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5-6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	NA
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	6



PRISMA 2009 Checklist

Page 1 of 2

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	6
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICO, follow-up period) and provide the citations.	7
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	8
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	9-14, Table 1
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	NA
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	8, Table 2
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	NA
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	14-18
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	18
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	18-19
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data; role of funders for the systematic review).	20

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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Activities Outside of the Care Setting for People with Dementia: A Systematic Review

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Primary Subject Heading:	Geriatric medicine
Secondary Subject Heading:	Mental health, Patient-centred medicine, Public health
Keywords:	Dementia < NEUROLOGY, GERIATRIC MEDICINE, Physiology < NATURAL SCIENCE DISCIPLINES

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3 **Title:** Activities Outside of the Care Setting for People with Dementia: A Systematic Review
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ABSTRACT

Objectives To summarise the evidence from interventions investigating the effects of out of care setting activities on people with dementia living in residential aged care.

Design Systematic review.

Methods A systematic search of electronic databases (PubMed, PsycINFO, Scopus, Web of Science, and the Cochrane Library) was performed to identify intervention trials published from journal inception to January 2020. Controlled trials, or quasi-experimental trials which measured pre-, post-, or during-intervention outcomes, where the participants were required to leave the care setting to participate in an intervention, were eligible for inclusion. Quality appraisal of the studies was performed following the Cochrane Collaboration's Risk of Bias or Newcastle-Ottawa Scale tools.

Results Of the 4,155 articles screened, eleven articles met the inclusion criteria from nine different studies. The number of participants in the studies ranged from six to 70 people living with dementia and lasted for three weeks up to five months. The interventions were aquatic exercise, wheelchair cycling, art gallery discussion groups, an intergenerational mentorship program, horse riding, walking, and outdoor gardening. Overall, the studies indicated preliminary evidence of psychological (n=7), physical (n=4), and physiological (n=1) benefits, and all interventions were feasible to conduct away from the aged care facilities. However, the low number of participants in the studies (n=177), the absence of a control group in all but three studies, low adherence, and potential for selection bias, limits the generalisability of the findings.

Conclusions Activities outside of the residential aged care setting have the potential to be effective at providing a range of benefits for people living with dementia. Higher quality studies are required to encourage care providers to implement these type of activities in dementia care settings.

PROSPERO registration number CRD42020166518

STRENGTHS AND LIMITATIONS

- To our knowledge, this is the first systematic review to examine the effects of activities outside of the care setting in people with dementia.
- The different types of interventions with quantitative results are summarised, appraised, and their benefits discussed.
- Only nine different interventions, from 11 publications were identified, highlighting a need for more research in this area.

BACKGROUND

A high proportion of people living in residential aged care facilities (RACF) (also known as nursing homes, long-term care, care homes, and assisted living among others) are living with dementia. Generally, people living with dementia in RACF have more progressive dementia and greater physical limitations than those living in the community and often require high levels of care.¹ As such, there is increasing recognition of the importance of providing high-quality, 24 hour care in RACF and dementia care settings. While the quality of care and the care environment is undoubtedly critical to health outcomes, access to meaningful activities and leisure in these settings can enhance physical functioning and cognitive and mental health.² Person-centred care is based on respecting the values and priorities of the person and in RACF as it promotes quality of life, dignity and autonomy. Psychosocial interventions and meaningful activities for people with dementia can form an important part of person-centred care and include engagement with art and music, use of assistive technology, life-story work, and horticultural therapy.²

Previous studies have indicated that psychosocial interventions provide positive effects on mood, apathy, and have the potential to reduce depression in people living in RACF.³ With the exception of horticultural therapy, which typically occurs outdoors but on the premises of a RACF, these activities commonly occur indoors. Several reviews have evaluated the effects of psychosocial

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3 interventions across community and RACF settings which promote beneficial psychological, physical,
4 and cognitive effects.²⁻⁵ However, to our knowledge, there has not been a consolidation of the evidence
5 relating to the effects of participating in meaningful activities outside the RACF setting, on people
6 living with dementia. Although it is established that being outdoors reduces stress and anxiety in people
7 with dementia⁶, safe and regular access to meaningful activities outside of the RACF are typically not
8 possible without assistance from family or care staff.⁷ Recently, connecting people to their community
9 and the outdoors is becoming an increased focus of aged care models as part of person-centred care
10 principles and dementia-friendly communities. Activities outside of the care setting for older people
11 and people with dementia have the potential to enable them to engage with the broader community, and
12 have sense of community, contribution, belonging, and social connectedness. These activities may also
13 be activities they engaged in before moving to a RACF. Therefore, we systematically examined the
14 literature which tested psychosocial interventions that enabled people living with dementia to leave the
15 care setting to participate in activities outside of the RACF. The findings of this review will provide
16 clarification to the current evidence base, with the aim to determine which interventions are the most
17 effective in promoting well-being in this population as well as identify priority areas for future research.
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35 **METHODS**

36 **Protocol and Registration**

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39 Methods for this systematic review followed the checklist from the Preferred Reporting Items for
40 Systematic Reviews and Meta-Analyses (PRISMA) guidelines.⁸ The review was preregistered on the
41 International Prospective Register of Systematic Reviews (PROSPERO) (CRD42020166518). Patients
42 and the public were not involved in the design, conduct, reporting, or dissemination of this research.
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50 **Selection Criteria**

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52 All comparative quantitative intervention studies, excluding case studies, were included. A PICOS
53 (population, intervention, comparator, outcomes, and setting) approach was used to guide the structure
54 of the systematic review:
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- Population: Human participants living in a RACF (also referred to as long term care, nursing home, care home and residential care) with any form of dementia or cognitive impairment.
- Intervention: Controlled trials, or quasi-experimental trials which measured pre-, post-or during-intervention outcomes, where the participants left the RACF setting to participate in the intervention.
- Comparator: Using an active control condition, usual care, or comparing pre- and post-intervention outcomes.
- Outcomes: Any quantitative methods evaluating participant outcomes (directly or indirectly) which measure psychological health and well-being.
- Setting: Participants must be living in a RACF.

Search Strategy

Electronic database searches of PubMed, PsycINFO, Scopus, Web of Science, and the Cochrane Library were performed for articles published from database inception to January 2020. The keyword search was: dement* OR alzheimer* OR "cognitive impairment" AND psychosocial OR non-pharmacological OR "leisure activities" OR "activity program" OR outdoor* OR outside OR horticultur* OR museum OR gallery OR music OR dance OR choir OR cafe OR theatre OR theater OR film OR movie* OR "meaningful activity" OR "occupational therapy" AND "aged care" OR institution* OR "nursing home" OR "long term care" OR "care home" OR "residential care" (Supplementary File). The reference lists of all included studies, and related existing systematic reviews, were searched for additional relevant articles. The searches were re-run prior to finalisation of the data analysis on the 15th of May, 2020.

Study Selection and Data Extraction

Eligible studies met the following criteria: use a controlled study design, or compared pre- and post-intervention effects; involved human participants of any age living in a RACF with dementia or cognitive impairment, and quantitatively examined the effects of an intervention which required

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3 participants to leave the RACF setting. Studies were excluded if they were epidemiological or
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5 qualitative studies, reviews, abstracts, conference papers or study protocols.
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8 Two authors (N.D. & N.N.) independently performed the searches using Covidence systematic
9
10 review software (Veritas Health Innovation, Melbourne, Australia). Following the removal of
11
12 duplicates, articles were excluded based on title and abstract screening using the selection criteria. For
13
14 articles where this was unclear, the article was carried forward into the full-text review. The full-text of
15
16 each article was read and assessed by the same authors, and independently evaluated to determine if all
17
18 selection criteria were met. The authors met to discuss each article, and a third author (S.I.) was present
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20 to resolve disagreements.
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23 A customised data extraction form was used to enter data from each article by one author (N.D.)
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25 and cross-checked by a second author (S.I.). This included the aims, study design, description of the
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27 intervention, details of selection criteria (for example: severity of dementia (where applicable), age,
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29 level of care), outcomes and measures, and results. For included studies that used mixed-methods, only
30
31 the quantitative results were presented and discussed. In addition, if studies included people with
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33 dementia living in RACF and in the community, only the data from the participants in RACF were
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35 presented where possible. The results of the included studies were synthesised quantitatively and
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37 qualitatively.
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40 41 **Quality Assessment** 42

43 Due to the broad inclusion criteria, two risk of bias tools were used independently by two researchers
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45 (N.D & S.I.). For randomised controlled trials, the Cochrane Collaboration's Risk of Bias tool was
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47 used.⁹ The criteria for this tool assesses risk of bias for sequence generation, allocation concealment,
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49 blinding of participants, personnel, and outcome assessors, incomplete outcome data, and selective
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51 outcome reporting. For each criterion, studies were assessed for risk of bias as low, unclear, or high.
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53 For non-randomised and quasi-experimental studies, the Newcastle-Ottawa Scale (NOS) for non-
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55 randomised studies was used for the quality assessment.¹⁰ The NOS assesses methodological quality
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57 based on participant selection, comparability of treatment groups, and outcome ascertainment with a
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3 maximum score of nine. Currently, there is no recommended tool to assess quality for quasi-
4 experimental studies with only a treatment group, the highest possible score for these studies was six
5 as previously described.¹¹
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10 **RESULTS**

11 **Study Selection**

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16 The systematic review search resulted in 6453 records for screening and 2,308 duplicates were removed.
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18 Ten articles were identified through searching of the reference lists of relevant systematic reviews and
19 included articles. Following title and abstract screening, 173 references remained for full-text review.
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21 In total, 162 records were excluded. In order, the articles were excluded because they failed the inclusion
22 criteria for the following reasons: not published in English (n = 4), not a journal article (conference
23 abstract or not peer reviewed) (n = 12), wrong study design (qualitative study or survey) (n = 11), wrong
24 population (participants not living with dementia, or participants not living in a RACF) (n = 20), and
25 wrong intervention (intervention did not require participants to leave the RACF (n = 114). One study
26 was excluded as we were unable to receive clarification from the authors as to whether participants left
27 the RACF for the intervention. Eleven articles reporting on nine different studies fit the inclusion
28 criteria.¹²⁻²² The PRIMSA flow chart is presented in Figure 1. A meta-analysis was not performed due
29 to the diversity of the included interventions and the reported outcome measures.
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42 **Study Characteristics**

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45 Of the eleven included articles¹²⁻²², four reported on two different studies. Therefore, nine total studies
46 were included. The nine studies reported on data from a total of 177 participants living in RACF from
47 high-income countries, Australia^{14 17-21}, the United States^{12 13 15 16}, and Sweden.²² (Table 1). Study
48 sample sizes ranged from six¹⁵ to 70.¹³ Two studies were randomised controlled trials^{12 13 16}, one study
49 was a controlled trial¹⁷, and the remaining six studies used quasi-experimental designs.^{14 15 18-22} The
50 participants ranged in age from 77.0¹⁹ to 88.4 years.^{18 21}
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58 **Interventions**

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3 Three of the articles included people living with dementia participating in a swimming-based program
4 at a local pool.^{17 18 21} Two of these articles were from the same pilot study.^{18 21} Two articles were from
5 one study of a recreational program which included wheelchair cycling.^{12 13} Two studies were of arts-
6 based discussion at an art gallery.^{14 20} The remaining studies were horse riding (equine-assisted
7 activities)¹⁵, mentorship visits as part of an intergenerational program¹⁶, gardening at a park adjacent to
8 the RACF²², and supervised walks in the community.¹⁹ The duration of the interventions lasted from
9 two weeks¹² to five months.¹⁶

18 **Outcome Measures**

21 Four articles assessed behavioural and psychological symptoms including agitation.^{12 13 17 21} Four
22 articles assessed depressive symptoms.^{13 14 16 17} Four articles assessed physical function^{14 17 18 22}, and
23 one study evaluated quantitative characteristics surrounding walks outside of the RACF including the
24 number of walks taken, and reasons for walks not proceeding.¹⁹ Two studies each assessed cognitive
25 function^{14 16}, and anxiety.^{16 17} One study assessed cognitive function at baseline to determine if it
26 affected participation in gardening activities.²² One article assessed self-reported quality of life¹⁴, and
27 one used an observer-rated QoL instrument.¹⁵ One article each assessed changes in the number of sleep
28 disturbances¹³, physiological outcomes (salivary cortisol and interleukin-6)¹⁴, and activities of daily
29 living.¹⁷ During the intervention, four articles assessed changes in activity participation and
30 engagement^{12 13 15 20}, and one article rated well-being.¹⁴

43 **Quality Assessment**

46 The selection criteria allowed the inclusion of randomised, non-randomised studies, and quasi-
47 experimental studies. Therefore, the included studies were mostly preliminary by study design and did
48 not represent conclusive evidence of the efficacy of the interventions. Two randomised controlled trials
49 were evaluated using the Cochrane risk of bias tool (Table 2).^{12 13 16} Two publications (one study) about
50 wheelchair cycling were rated as most unclear, and high risk of bias for allocation concealment.^{12 13} The
51 wheelchair cycling studies, and the study by George et al. (2011) were rated with high risk of bias for
52 blinding of personnel and participants.^{12 13 16} However, the study by George et al. (2011) was rated low
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3 or unclear for the other criteria. The remaining studies were assessed using the Newcastle-Ottawa
4 Quality Assessment for non-randomised studies. Only the study by Henwood et al. (2017) was scored
5 out of nine due to the presence of a control group (8/9).¹⁷ The six other studies were of good quality
6 (4/6 – 5/6) (Table 3).^{14 15 18-22} All six of these studies received a score of zero for “Outcome assessment”
7 as they were not independent blind assessments. Two studies did not recruit representative samples.¹⁵
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²² The study by Fields et al. (2018) recruited participants with horse riding experience¹⁵, and the study by Thelander et al. (2008) selected participants with a documented history of agitated or restless behavior.²² The first swimming study lost greater than 25% of participants due to attrition and was rated zero in the “Adequate cohort follow-up category”.^{18 21}

Narrative Synthesis of Intervention Effects

Three articles from two studies by the same research team, investigated the effects of twice weekly participation in the Watermemories Swimming Club.^{17 18 21} The program aimed to create positive memories in people who previously enjoyed swimming. The pilot study results were reported in two publications by Neville et al. (2014) and Henwood et al. (2015) with eleven people with dementia recruited from two RACF.^{18 21} The twelve-week intervention incorporated supervised aquatic exercise at a local municipal pool and was designed to promote physical and functional ability. The study by Neville et al. (2014) reported outcome measures of psychological well-being.²¹ The Psychological Well-Being in Cognitively Impaired Persons Scale (PW-BCIP) and the Revised Memory and Behaviour Problems Checklist (RMBPC) were used to assess positive and negative affective states and engagement, and behaviour, agitation and depression (BPSD), respectively. Data were collected at baseline, week six, week nine, and post-intervention. Across time points, improvements were observed in the PW-BCIP (n = 8; p = 0.034), RMBPC (BPSD frequency) and RMBPC (staff reaction to BPSD) (both; n = 10; p = 0.001). The study by Henwood et al. (2015) focused on physical and functional benefits of the Watermemories Swimming Club.¹⁸ The outcome measures were hand grip muscle strength and body composition, with balance and functional capacity measured by two composite measures, the Balance Outcome Measure for Elder Rehabilitation (BOOMER) and the Short Physical Performance Battery (SPPB). Of the ten participants who provided data, an improvement in left hand

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3 grip strength was observed ($p = 0.017$). Both positive and negative non-significant trends were observed
4 for other outcomes. However, transportation of people with dementia from the RACF to a swimming
5 pool was considered feasible and set the foundation for the controlled trial by Henwood et al. (2017).¹⁷
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7 This study was also a twelve-week intervention, but included a control group. The outcome measures
8 were the same as the pilot study^{18 21}, but also included the Cornell Scale for Depression in Dementia
9 (CSDD), Geriatric Anxiety Inventory (GAI), KATZ Activities of Daily Living Scale, and sarcopenia
10 status using the European Working Group in Older People (EWGSOP) criteria. Of the two RACF
11 involved in this study, one had considerably better compliance (87.5% vs 44.6%). The analytic sample
12 consisted of nine participants in both the intervention and control groups. Both groups had a decrease
13 in Skeletal Mass Index (SMI) and lean mass post-intervention ($p = 0.002$; $p = 0.001$, respectively). A
14 significant group by time interaction was observed for left- and right-hand grip strength ($p = 0.017$; $p =$
15 0.003 , respectively), driven by large decreases in the control group ($p \leq 0.026$). Sarcopenia prevalence
16 was increased post-intervention in both groups compared to baseline, increasing from four to six
17 participants in the intervention group ($p = 0.038$) and from one to all nine participants in the control
18 group ($p = 0.002$). Greater improvements were observed in the intervention group in the behavioural
19 and psychological outcomes and activities of daily living, but these were non-significant (all, $p > 0.05$).
20 Overall, the results of these studies reveal that away from the RACF, swimming is feasible, although
21 both studies had participant attrition.
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42 Wheelchair Cycling was the intervention in two articles from one study of recreational therapy
43 activities.^{12 13} In this activity, people with dementia and depressive symptoms sat in a wheelchair
44 attached to a half bicycle and receive a 15-minute ride where conversation with the cyclist was
45 encouraged. An intensive two- week program with daily rides on the weekdays was first implemented
46 with 41 and 29 participants from two RACF (total, $n = 70$). This was followed by a ten-week
47 maintenance period where each participant went for a ride twice per week. The primary outcome in the
48 first study was change in depressive symptoms assessed using the Geriatric Depression Scale (Short-
49 form).¹³ The intervention group had reduced depressive symptoms between baseline and after the
50 intensive two-week program ($p < 0.001$) and between baseline and after the ten-week maintenance
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3 program ($p < 0.001$). Depressive symptoms in the control group increased between baseline and by the
4 end of the intensive two-week program ($p = 0.047$). Sleep disturbances were also recorded in one of the
5 RACF participating in the study ($n = 41$). At baseline, sleep disturbances were reported in five
6 participants in the intervention group and four in the control group. After the intensive two-week
7 program, sleep disturbances were reported in two people in the treatment group and nine in the control
8 group ($p < 0.001$). Activity participation increased in the intervention group between baseline and
9 following the intensive two-week program ($p < 0.001$), and in the maintenance program ($p < 0.001$).
10 Between baseline and the end of the maintenance program, the control group were participating in fewer
11 activities ($p = 0.016$). The second study compared the amounts of encouragement and engagement,
12 agitation, and mood levels in a sub-sample of 54 participants who received the wheelchair biking during
13 the intensive two-week program with the 72 other recreational activities that were carried out over the
14 two weeks.¹² These activities included playing cards, painting, music, pet therapy, and walking.
15 Participants spent longer participating in wheelchair cycling ($p < 0.001$). Less encouragement, higher
16 mood, lower agitation, and greater engagement were all observed for wheelchair cycling compared to
17 the other activities. Only the effect for engagement was statistically significant ($p < 0.001$). The results
18 of these two studies demonstrated benefits from being outside participating in wheelchair cycling in
19 people with dementia and depression in RACF's.

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41 Two studies of the National Gallery of Australia Art and Dementia program met the inclusion
42 criteria.^{14 20} In both studies, each with an intervention period of six weeks, participants who were living
43 in RACF were transported to the art gallery by bus and were accompanied by care staff. Most
44 participants were recruited because care staff believed they would benefit from the program. The Art
45 and Dementia program at the National Gallery of Australia is similar to the program pioneered by the
46 Museum of Modern Art in New York City.²³ Typically, participants discuss and engage with artworks
47 from the galleries collection during a one hour pre-planned tour. The study by MacPherson et al. (2009)
48 recruited 15 people living with dementia, eight from a single RACF.²⁰ Prior to the study, participants
49 were reported to manifest significant challenging behaviours in their daily life. Observer-rated video
50 analysis of the week one and five visits to the art gallery revealed an increase in observations coded as
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3 “very engaged” ($p = 0.03$). Two to three weeks after the final visit, one participant was able to clearly
4 remember the program, while others remembered aspects when prompted, and two did not remember.
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6 The study by D’Cunha et al. (2019) at the same art gallery recruited 28 participants and 25 completed
7
8 pre- and post-intervention, and follow-up outcome measures (quality of life, depressive symptoms, and
9
10 cognitive performance).¹⁴ Of the 25 participants, 22 were living full time in a RACF. Improvements
11
12 were observed in each of the outcomes (all p ’s < 0.05), except for proxy-rated quality of life ($p = 0.076$).
13
14 Unique to the literature on art gallery programs for people living with dementia, this study also
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16 evaluated changes in salivary cortisol and interleukin-6 ($n = 22$), and hand grip strength. The waking to
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18 evening salivary cortisol ratio improve between pre- and post-intervention ($p = 0.033$), indicating a
19
20 more dynamic diurnal cortisol rhythm in response to the intervention. In both studies, engagement was
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22 high for all participants throughout both six-week periods. Together, these studies highlight that it is
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24 feasible to transport people living with dementia to local galleries and museums, and that specifically
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26 tailored programming has a range of benefits. However, notably, both studies were lacking control
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28 groups and participants were selected based on their likelihood to enjoy and derive benefits from the
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30 program.
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36 The longest included study was a randomised controlled trial of a five month intergenerational
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38 mentorship program which included 15 people living with dementia and students at an intergenerational
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40 school.¹⁶ The school was one of the first educational programs to enable people living with dementia to
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42 provide mentorship to younger people in a structured voluntary role. Over the five months, the
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44 participants alternated between one hour visits to a kindergarten and a sixth grade classroom for a total
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46 of 20 hours. In each class, a participant worked with two to three students and engaged in intergeneration
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48 life-history reminiscence sessions. The control group engaged in a peer education seminar titled
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50 “Successful Aging: Reclaiming Elderhood” and received take home assignments so the time
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52 commitment was equal to the intervention group. The results indicated decreased anxiety and stress in
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54 the intervention group and an increase in the control group ($p = 0.049$). Despite the small sample size,
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56 this finding supports intergenerational volunteering as a meaningful activity to promote quality of life
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3 for people living with dementia which may also help to reduce stigma of dementia through engagement
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5 with children.
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8 The study by Field et al. (2018) investigated associations between nine different activities, one
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10 being horse riding (equine-assisted activities) at a therapeutic riding centre.¹⁵ Eight people with mild-
11 moderate stage dementia and previous experience with horses were recruited from a single RACF;
12 however, only six participants met criteria to be included in the analysis. The effects of horse riding
13 were compared to a range of activities at the RACF including watching television, games, music, during
14 meals, and physical therapy. A modified version of the Activity in Context and Time observational
15 instrument was used to evaluate environment correlates of quality of life, and specific indicators related
16 to agitation and apparent affect, with the latter derived from the Apparent Affect Rating Scale. Trained
17 researchers used a hand-held computer to record observations using an instantaneous sampling strategy
18 at ten minute intervals for four hours twice per week for eight weeks. The participants travelled by bus
19 to the riding facility each week for eight weeks for the therapeutic horse riding intervention and were
20 given the choice of riding, grooming, petting or observing the horses while being guided by volunteers.
21 Levels of conversation ($p < 0.001$) and apparent affect ($p = 0.001$) were improved in horse riding
22 compared to the other activities. The ability of the participants to converse, maintain their gaze, show
23 pleasure, and participate in complex activities were more frequently observed in the horse riding
24 activity. Based on this small study, horse riding is considered a safe and enjoyable activity to promote
25 quality of life of people with dementia living in RACF.
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45 A Safe Walking Program was investigated by MacAndrew et al. (2019) in seven people with
46 severe dementia who were prone to high intensity wandering from two RACF.¹⁹ The three-week
47 intervention involved supervised walks outside the RACF each weekday. The timing of the intervention
48 was calculated to be 30 minutes before when the participants were most likely to wander (between 7
49 am and 7 pm) as determined using Actigraph™ activity monitoring. The walks were facilitated by one
50 trained “interventionist” around the predetermined routes in the immediate neighbourhood of the
51 RACFs. Each “interventionist” followed a set protocol fidelity checklist which was completed at the
52 end of each walk and served as the quantitative outcome measure. The checklist included the pre-walk
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3 preparation activities, the time and duration of the walk (30 minutes), whether the prescribed route was
4 followed, and any deviations to the protocol. In total, 86 of the 105 (80%) planned walks were
5 completed according to the protocol fidelity checklist for an average of 12.3 walks per participant out
6 of 15. Ninety-one percent of the walks lasted for the full 30 minutes. The Safe Walking Program was
7 found to be practically feasible and perceived to have benefits for people with dementia who wander.
8 After the study, staff reported that some participants seemed to walk with more purpose and were more
9 likely to be attracted to areas where group activities were occurring.
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19 Outdoor gardening was the intervention in the study by Thelander et al. (2008).²² Eight residents
20 of a RACF were recruited for 40-70 minute gardening sessions, three time per week over a six-week
21 period, in groups of two or three participants. Five of the participants used a walking frame. The
22 gardening took place in a park adjacent to the RACF, and activities focused on park maintenance
23 including tidying gravel paths, weeding, composting, and planting flowers, although there was
24 flexibility to perform other tasks within the participants physical capabilities. Participants were
25 observed and rated using a “Six-degree independence scale” designed specifically for this study which
26 evaluated the levels of assistance required to perform the activities from independent to not participating
27 in activities. Generally, there were no fluctuations between residents’ independence across the
28 intervention, and each resident participated between 10-15 times and rated between two (carried out
29 activity with supervision) and five (extensive need for help). Baseline score on the MMSE had no
30 significant effect on level of independence ($p = 0.50$), although more help was required in participants
31 with more severe dementia. The study demonstrated that people with dementia living in a RACF can
32 be safely enabled to participate in gardening activities which have the potential to improve physical and
33 functional capacity in small supervised groups.
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50 51 **DISCUSSION**

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54 There is a need for engaging activities that are enjoyable and enable social connection for people living
55 with dementia in RACF. To our knowledge, this is the first systematic review to collate the results of
56 all studies which facilitated participation in activities within the community for people with dementia
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3 living in RACFs to leave their facility as part of an intervention. Studies of wheelchair cycling,
4 swimming, art gallery visits, intergenerational mentorship, horse riding, walking, and outdoor
5 gardening were identified. However, due to a paucity of studies, we could not determine which
6 interventions are the most effective in promoting well-being. Each study focused on different outcomes
7 however, it was demonstrated that activities outside the care setting were feasible and had the potential
8 to offer psychological and physical benefits to people living with dementia. Overall, there was an
9 absence of randomised controlled trials and no blinded studies. This may be due to several factors
10 including practical difficulties in performing large blinded studies in RACF settings, the cost to
11 undertake this research, and the need for RACF staff to be present in order to ensure the safety of the
12 participants. The findings of the present study identify a need for further research into how these
13 activities can be sustainably and adequately implemented for people with dementia in the RACF setting.
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26 27 *Psychological outcomes*

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29 Most of the studies in this review included a psychological outcome, and demonstrated the potential for
30 improvements in well-being^{12-14 21}, quality of life¹⁴, mood^{12 13 15}, cognition¹⁴, and reducing depression¹²⁻¹⁴
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3 by MacAndrew et al. (2019), staff found that the walking program enriched the lives of the participants,
4 who were selected due to their wandering, and even created positive change in the walking and
5 wandering habits of some participants.¹⁹ While dementia is a cluster of incurable conditions, social
6 participation and engaging in activities away from the RACF has the potential to prolong quality of life
7 and potentially reduce behavioural symptoms in the care setting.
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13 *Physical outcomes*

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17 Swimming, gardening, horse riding, and walking were physical activities used in the included studies.
18 In particular, physical benefits, in the form of grip strength and a reduction in sleep disturbances were
19 observed as a result of the swimming^{17 18} and wheelchair cycling^{12 13}. Grip strength is a widely used
20 marker of whole body muscular strength which is associated with vitality, physical function, and
21 cognitive performance.^{31 32} Swimming improved grip strength^{17 18}, but no benefits were observed for
22 grip strength following six weeks of arts-based discussion groups¹⁴, suggesting that physical activity is
23 required to see improvements. Swimming for older people has many benefits including an increase in
24 metabolism which can help with sleep and appetite, in addition to being a non-weight bearing form of
25 physical activity which enables a full range of motion and joint mobility. A reduction in sleep
26 disturbances was observed in response to wheelchair cycling.^{12 13} Individualised social activities have
27 been shown to improve sleep drive and the circadian rhythm in people with dementia, and reduce
28 daytime sleepiness.³³ It has also been demonstrated that multi-component interventions and light
29 therapy can improve sleep quality.³⁴ While sleep outcomes were not assessed in the outdoor gardening
30 study by Thelander et al. (2008), therapeutic gardens may also improve sleep-wake cycles of people
31 with dementia.³⁵ Benefits can be observed from simply getting outdoors to receive increased exposure
32 to natural sunlight.³⁶ Gardening at a local park, and walking represent ideal opportunities for people
33 with dementia to engage in physical activity in an outdoor environment.^{19 29} The use of gardens and
34 green spaces in the community represents an enabling environment for people with dementia where
35 they can engage in meaningful activity and achieve a sense of contribution and connection with their
36 community.³⁷ In the broader literature, the highest quality evidence for physical interventions in
37 dementia such as strength training and aerobic exercise, included a social aspect,² and it is possible that
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3 the physical interventions identified in this review (swimming, walking, gardening, and horse riding)
4 may result in more benefits because they also involved this social aspect and took place within the
5 community setting.
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10 *Physiological outcomes*

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13 The assessment of the physiological markers in psychosocial interventions for people with dementia is
14 a relatively new and emerging area of research.³⁸ The study by D’Cunha et al. (2019) found an
15 improvement in the diurnal cortisol rhythm after participating in arts-based discussion groups over six
16 weeks.¹⁴ Cortisol is the bodies primary stress and awakening hormone, and impairments in the diurnal
17 rhythm in dementia are associated with lower hippocampal volume, increased agitation, decreased
18 resiliency, and greater cognitive impairment, and is associated with depression.^{14,39} Decreases in skeletal
19 muscle mass and lean body mass were observed after participation in the Watermemories swimming
20 club and in the control group.^{17,18} However, a greater decrease was observed in the control group. The
21 maintenance of muscle mass in older people may have implications for falls prevention, and swimming
22 can potentially improve balance, gait, and functional status.⁴⁰ The measurement of physiological
23 responses such as stress hormones levels, skin responses, and heart rate variability, have been associated
24 with well-being and mental health in dementia and are likely to be improved following activities outside
25 of the RACF.³⁸
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41 The capacity to facilitate meaningful activities outside the care setting may require planning
42 and resources beyond that needed for activities within the care settings. This includes the availability
43 of adequate staff, suitable transportation, assessing the physical abilities and needs of the residents and
44 the suitability of the activity itself. The findings from this review demonstrate that travel into the
45 community is not required for benefits, with the wheelchair cycling^{12,13}, walking¹⁹, and gardening²²
46 studies taking place within close proximity to the RACF, making them practical and accessible for care
47 staff and people with dementia. The studies that involved art gallery visits^{14,20}, horse riding¹⁵, and
48 swimming^{17,18,21} required the participants to travel to participate in the activity which requires suitable
49 transport and adequate storage space for mobility equipment and care staff or volunteers. None of the
50 included studies detailed how the travel occurred, but all indicated that they incorporated volunteers or
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3 researchers in addition to regular staff. Safety of the residents is an important consideration in the
4 feasibility of using spaces outside a RACF, and the need for supervision can restrict potential feelings
5 of autonomy.⁷ For example, in the gardening study, the participants required supervision and there was
6 difficulty in caring for the participants at the same time even though group sizes were limited to two or
7 three.²² The size of the RACF, and the number of residents, are also factors in the potential for
8 community-based activities to occur.⁴¹ Despite these potential barriers, activities in the community
9 should be encouraged and can be enjoyed by people with dementia. It is important to weigh up the
10 benefits of activities outside the RACF with the risks, and ensuring that people with dementia have the
11 right to choose whether they want to take some risk to engage in meaningful activities.⁴²
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23 **Limitations**

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25 The weakness of the included studies was primarily seen in their study design. Only two studies were
26 performed in a randomised controlled fashion and did not perform any blinding^{12 13 16}, and one study
27 was a controlled trial without randomisation.¹⁷ The remainder of the studies were limited by their quasi-
28 experimental design.^{14 15 18-22} Quasi-experimental, non-randomised studies aim to stimulate and inform
29 more rigorous interventional research, and if well-conducted, can provide evidence for causal
30 inference.⁴³ Overall, limited conclusions can be made based on the included studies due to their sample
31 sizes and preliminary nature. However, evidence supporting psychosocial interventions for people with
32 dementia are inherently difficult to conduct, may have challenges associated with recruitment and
33 informed consent, and may place additional demands on staff or carers. Accordingly, this form of
34 evidence is often the best available and can help inform the implementation of low risk activities and
35 interventions in the care setting. Moreover, if there is evidence that participation in an activity can
36 provide even a modest benefit then it should be encouraged. We are also limited by the lack of quality
37 assessment tools that are tailored to use to evaluate the included studies, particularly for the quasi-
38 experiment studies as there is not one recommended tool for appraisal.
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55 **Future Directions**

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3 While field trips and outings frequently occur at many RACF, there is a need for more well-funded and
4 adequately designed research to identify and overcome the barriers to implementation to enable greater
5 participation in the community for people with dementia. The logistics and cost of transporting groups
6 of older people and people with dementia represents a possible barrier, and research and policy work
7 are required to determine how to maximise opportunities for people with dementia to participate safely
8 in the community. Given that transportation represents a barrier to participation, future research should
9 also investigate the potential to use a variety of public and community transport options, which may
10 also include ride-sharing and autonomous vehicles as a potentially safe method of transportation for
11 people with dementia. There is also a need for systems to be in place to best utilise existing public
12 spaces, such as art galleries and museums and even local parks. One of the most significant effects of
13 engaging in activities outside of the RACF is a reduction in falls; however, this outcome was not
14 assessed in any of the included studies. As reduction in the likelihood of falls can reduce morbidity and
15 mortality, prospective studies are needed to determine if dementia-specific activities outside of the
16 RACF can reduce risk. Outside activities are not suitable for all people with dementia in RACF with
17 physical limitations or more progressed cognitive decline. Therefore, future research should investigate
18 how meaningful activities can be experienced in novel ways, for example through virtual reality
19 technology which can potentially provide people living in RACF the sensation of being outside and
20 provide opportunity for physical activity through exergaming.⁴⁴ Finally, future studies comparing
21 activities facilitated within and outside of RACF are needed to understand whether there are additional
22 benefits when activities are conducted outside of the care setting.
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45 **CONCLUSION**

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49 The findings of this systematic review demonstrate that there is currently limited, preliminary evidence
50 from interventions which enable people with dementia to engage in activities outside of the RACF
51 setting. The results suggest that activities outside of the RACF is associated with improvements in
52 psychological and physical health. The interventions in this review included a variety of activities with
53 varying degrees of accessibility. In order for greater participation in community, activities and programs
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3 to be achieved for people with dementia, high-quality studies are needed to establish an evidence-base
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5 and to understand barriers to implementation in the RACF setting.
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8 **Contributions**

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10 NMD conceived and designed the study, performed the searches and article screening, carried out the
11 data extraction and quality assessment, analysis and drafted the manuscript. SI helped design the study,
12 carried out of the quality assessment, and commented on the manuscript. JK and AJM provided critical
13 analysis on the manuscript. NN helped conceive and design the study, performed the searches and article
14 screening, and commented on the manuscript.
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23
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28 **Competing interests**

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30 All authors report no disclosures.
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33 **Patient and public involvement**

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35 No patients and/or the public were involved in this research.
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38 **Patient consent**

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40 Not required.
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44 **Data sharing statement**

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46 The data reported in this study are the results from publicly available peer-reviewed literature. Funding
47 bodies had no role in the inception, design, completion or publication of this work.
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Tables

Table 1. Summary of the included studies

Reference	Intervention	Methods	Participants	Outcome Measures	Results
Buettner & Fitzsimmons (2002) United States	Wheelchair cycling in two phases: 1. Small group discussions & 15-minute ride 5 times per week for 2 weeks, 2. Twice per week maintenance program to attend activities for 10 weeks.	RCT with data collection at pre, post phase 1, and post phase 2.	70 with dementia and depression, MMSE \leq 24, GDS-SF \geq 4, living in skilled nursing and assisted living. Age = Not reported.	GDS-SF, CMAI, sleep disturbances, activity participation.	Intervention group has lower depressive symptoms after phase 1 and between pre and phase 2 (both p's < 0.0001). No effect on CMAI. Sleep disturbances were improved in intervention group between pre and phase 1 (p < 0.0001). Activity participation improved in treatment group between pre and phase 1 & 2 (both p's < 0.001), and decreased in control between pre and phase 2 (p = 0.016).

<p>Buettner et al. (2013) United States</p>	<p>Two weeks (weekdays only) of individualised recreational therapy based on functional abilities (wheelchair cycling, painting, music, cooking, pet therapy, walking, and playing cards).</p>	<p>Sub-analysis of RCT with data collection at pre and post-intervention. Wheelchair cycling was compared to all other interventions.</p>	<p>54 with dementia and depression, MMSE \leq 24, GDS-SF \geq 4, living in skilled nursing and assisted living. Age = 86.1 years.</p>	<p>Engagement levels, minutes on task, and encouragement required.</p>	<p>Engagement was higher during wheelchair cycling compared with all other interventions ($p < 0.001$). Wheelchair cycling participants had a more positive mood, less agitation, and required less encouragement.</p>
<p>D’Cunha et al. (2019) Australia</p>	<p>Weekly visits for 6 weeks to a local art gallery for art based discussion in groups of 5-6. Trained educators delivered the intervention.</p>	<p>Quasi-experimental: Data collection at pre, post, follow-up.</p>	<p>25 with mild to severe dementia from five RACF (1 person from community). 22 provided biological samples. Age = 84.7 ± 7.27 years.</p>	<p>Pre, Post: Salivary cortisol, Interleukin-6, M-ACE, DEMQOL, DEMQOL-Carer, GDS-SF, Hand grip strength, GWQ.</p>	<p>Improvement in waking to evening salivary cortisol ratio ($p = 0.033$), DEMQOL ($p < 0.001$), GDS-SF ($p = 0.015$), immediate recall ($p = 0.009$), and verbal fluency ($p = 0.027$).</p>

					GWQ improved from visit 1 to 6 (p = 0.033).
Fields et al. (2018) United States	Weekly visits for 8 weeks to an equine-assisted activities program at a non-profit therapeutic riding centre.	Quasi-experimental: Intervention compared with all other RACF activities.	6 with moderate dementia from a RACF with previous experience with horses. Age = 83.3 years.	Real-time observations using modified version of Activity in Context and Time QoL indicator instrument	More positive responses in conservation (p < 0.001) and apparent affect (p = 0.001) in intervention compared with other activities.
Henwood et al. (2015) Australia	Twice weekly exercise sessions for 12 weeks at Watermemories Swimming Club with a trained swimming instructor and in-pool support from staff or carers.	Quasi-experimental: Data collection at pre and post.	10 people with dementia from 2 RACF. Age = 88.4 years.	BMI, Body composition, SPPB, BOOMER, Hand grip strength.	Left hand grip strength improved (p = 0.017).

<p>Henwood et al. (2017) Australia</p>	<p>Twice weekly exercise sessions for 12 weeks at Watermemories Swimming Club with a trained swimming instructor and in-pool support from staff or nursing students.</p>	<p>Controlled trial.</p>	<p>18 people with dementia from 7 RACF. Age = 82.4 ± 6.6 years.</p>	<p>BMI, Body composition, SPPB, BOOMER, Sarcopenic status, Hand grip strength, KATZ, RMBPC, PWB-CIT, CSDD, GAI.</p>	<p>Skeletal muscle index (p = 0.002) and lean mass (p = 0.001) decreased in both groups, and hand grip strength decreased in the control group (p ≤ 0.026). Improvements in intervention group approached significance for RMBPC (p = 0.06).</p>
<p>George & Singer. (2011) United States</p>	<p>Alternating weekly mentorship visits with a kindergarten and 6th grade classroom for 5 months.</p>	<p>RCT.</p>	<p>15 people with dementia from one RACF (8 in intervention, 7 in control). Age = 85.7 (Intervention), 81.4 (Control).</p>	<p>MMSE, BAI, BDI, single questions (sense of purpose, sense of usefulness).</p>	<p>BAI decreased in intervention group and increased in control group (p = 0.049).</p>

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MacAndrew et al. (2019) Australia	Each weekday for 3 weeks, residents were taken on a 30-minute supervised walk into the community outside the RACF.	Quasi-experimental: data collected surrounding each walk.	7 people with severe dementia from two RACF. Age = 77.0 years.	Feasibility data were collected as the percentage of congruence between walks according to pre-defined checklist.	Of 105 planned walks, 80% (n = 86) were completed. 91% of the walks lasted 30 minutes. Fatigue, pain, and desire to return were the most common reasons for walks not proceeding.
MacPherson et al. (2009) Australia	Weekly visits for 6 weeks to a local art gallery for art based discussion in groups of 5-6. Trained educators delivered the intervention.	Quasi-experimental: data collection at weeks 1 and 5.	8 people with moderate to severe dementia from two RACF. Age = 86.6 years.	Observer-rated video behavioural analysis at weeks 1 and 5.	Observations coded as “very engaged” increased between timepoints (p = 0.03).
Neville et al. (2014) Australia	Twice weekly exercise sessions for 12 weeks (with 2 week break) at Watermemories Swimming	Quasi-experimental: data collection at	10 people with dementia from 2 RACF. Age = 88.4 years.	RMBPC, PWB-CIP	Psychological well-being was different across timepoints (p = 0.034), increasing between

	Club with a trained swimming instructor and in-pool support from staff and friends or family.	baseline, weeks 6, 9, and post.			baseline and week 9, and declining at post-intervention. Fewer BPSD between baseline and weeks 6 and 9 in both frequency and distress to staff (both p's = 0.001).
Thelander et al. (2008) Sweden	Gardening activities in an adjacent park to the RACF for six weeks, three times per week.	Quasi-experimental: observations after each session.	8 people with dementia from one RACF. Age = 86.8 years.	Observations using six-degree independence scale assessing level of independent activities. MMSE performed at baseline.	Independence scale results ranged from 2 to 5. MMSE results had no influence on independence (p = 0.50).

Key: BOOMER: Balance outcome measure for elder rehabilitation, BMI: Body mass index, BPSD: Behavioural and psychological symptoms of dementia; CMAI: Cohen-Mansfield Agitation Inventory, CSDD: Cornell scale for depression in dementia, DEMQOL: Health-related quality of life (dementia), GAI: Geriatric anxiety inventory, GDS-SF: Geriatric depression scale (short-form), GWQ: General Wellbeing Questionnaire, KATZ: KATZ Index of independence in activities of daily living, M-ACE: Mini-Addenbrookes Cognitive Examination, MMSE: Mini-mental State Examination, PWB-CIB: Psychological well-

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3 being in cognitively impaired persons, RACF: Residential aged care facility, RMBPC: Revised memory and behavioural problem checklist, SPPB: Short
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5 physical performance battery.
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Table 2. Quality assessment of included randomised studies.

	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias
Buettner et al. (2002) & Buettner et al. (2013)	Unclear	High	High	Unclear	Unclear	Unclear	Unclear
George et al. (2011)	Low	Unclear	High	Unclear	Low	Low	Unclear

Table 3. Quality assessment of included non-randomised studies

Study	SELECTION				COMPARABILITY	OUTCOME			Overall Score
	Representativeness of cohort	Selection of non-exposed cohort	Exposure ascertainment	Demonstrate that outcome not present at study start	Comparability of cohorts	Outcome assessment	Adequate follow-up for outcomes to occur	Adequate cohort follow-up (< 25% attrition)	
D’Cunha et al. (2019)	1	N/A	1	1	N/A	0	1	1	5/6
Fields et al. (2018)	0	N/A	1	1	N/A	0	1	1	4/6
Henwood et al. (2015) & Neville et al. (2014)	1	N/A	1	1	N/A	0	1	0	4/6
Henwood et al. (2017)	1	1	1	1	1	0	1	1	8/9

MacAndrew et al. (2019)	1	N/A	1	1	N/A	0	1	1	5/6
MacPherson et al. (2009)	1	N/A	1	1	N/A	0	1	1	5/6
Thelander et al. (2008)	0	N/A	1	1	N/A	0	1	1	4/6

Figure Legend

Figure 1. PRISMA flow chart summary of systematic review search process.

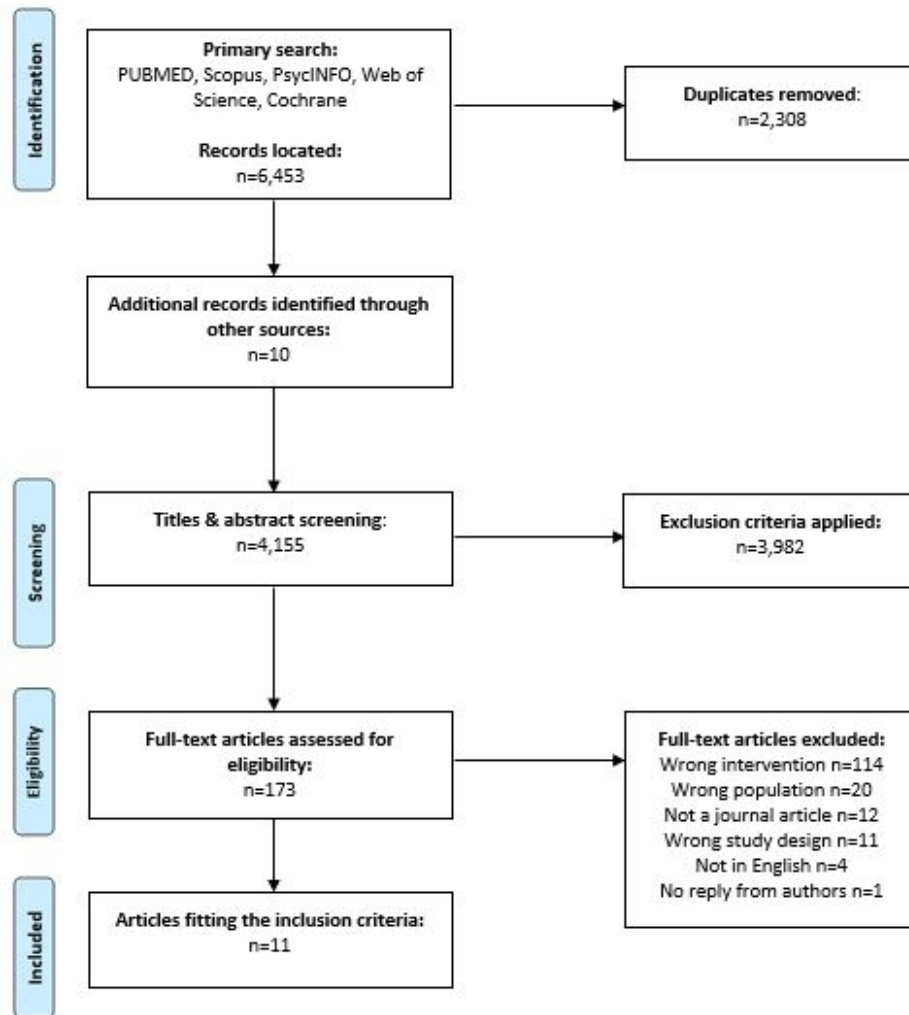


Figure 1. PRISMA flow chart summary of systematic review search process.

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- 3 1. ((dement* OR alzheimer* OR "cognitive impairment") AND
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- 5 2. (psychosocial OR non-pharmacological OR "leisure activities" OR "activity program" OR outdoor*
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- 7 OR outside OR horticultur* OR museum OR gallery OR music OR dance OR choir OR cafe OR
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- 9 theatre OR theater OR film OR movie* OR "meaningful activity" OR "occupational therapy")) AND
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- 11 3. ("aged care" OR institution* OR "nursing home" OR "long term care" OR "care home" OR
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- 13 "residential care".)
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16 *Filters applied: Clinical Trial, Randomized Controlled Trial.*

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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3-4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4-5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5-6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5-6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	NA
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	6



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	6
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	7
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	8
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	9-14, Table 1
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	NA
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	8, Table 2
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	NA
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	14-18
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	18
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	18-19
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	20

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