REVIEW

Insights for dementia risk reduction among lower SES adults in OECD countries: scoping review of interventions targeting multiple common health risk factors

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Abstract

The number of people living with dementia is expected to rise to 153 million cases globally by 2050. This will come at a high economic and human cost to societies with disproportionate effects on socioeconomically disadvantaged groups who experience greater exposures to- and fewer protections from- the environmental, social and behavioural drivers of dementia risk. Almost half (45%) of dementia incidence could theoretically be prevented or delayed by addressing 14 modifiable risk factors. While several studies have demonstrated the feasibility of multidomain dementia risk reduction interventions in relatively older, educated and wealthy populations, we are not aware of any studies to date explicitly targeting younger adults (< 50 years) with lower socioeconomic status. To inform future strategies, we conducted a scoping review of intervention studies targeting multiple 'dementia-related' risk factors among adults with lower socioeconomic status in developed country contexts. We identified 1003 unique records; 34 met our criteria for inclusion – involving more than 17,500 participants from 13 countries. While none of the studies explicitly targeted dementia risk reduction, they reported on 30 relevant multidomain interventions targeting common risk factors associated with dementia including; diet (28), physical inactivity (27), obesity (22), diabetes (9), hypertension (8), smoking (6), alcohol use (6), depression (3) and social isolation (1). While most studies recorded positive effects on one or more health behaviours, there was a diversity in the design, approach and outcomes of interventions, with significant intervention effects being associated with the use of a wider range of behaviour change techniques. We suggest that designing interventions to reduce dementia risk and disparities requires a high degree of contextual specificity and propose a structured and participatory approach.

Keywords Dementia, Alzheimer's disease, Prevention, Risk reduction, Health equity, Low socioeconomic status

Introduction

The global surge in dementia prevalence, including Alzheimer's disease predicted in coming decades is expected to bring about enormous social, economic and health system challenges. Modelled estimates see an almost tripling in the number of people with dementia from 57 million in 2019 to 153 million cases in 2050, due to population aging [1].

Dementia shares a number of risk factors in common with other diseases like cardiometabolic disorders and some cancers [2, 3]. Like other chronic diseases, dementia

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also disproportionately affects certain groups in society [4–7] and people with lower socioeconomic status (SES) experience an increased risk and earlier onset of dementia compared to those with relatively greater advantage [8–11]. These demographic differences can be explained by a range of socially determined factors that influence health choices and behaviours – such as lower levels of education and health literacy, fewer social and financial resources, greater exposure to unhealthy environments and lower levels of access to, and consumption of, health and health promoting services [12]. Studies have also described a complex set of biopsychological processes and adaptations adversely affecting health that are associated with increased exposures to stress and inflammation among lower SES groups [13, 14].

With dementia treatments still in progress, public health initiatives targeting modifiable risk factors hold great potential for preventing and delaying disease onset—and for mitigating the high human and economic costs [9, 15–19]. While age remains the primary risk factor, almost half (45%) of dementia cases could theoretically be averted by minimizing modifiable risk factors present at key life stages [15]. Low educational attainment in early life, hearing loss, high low-density lipoprotein (LDL) cholesterol, depression, traumatic brain injury, physical inactivity, diabetes, smoking, hypertension, obesity and excessive alcohol in midlife (45–65 years), and social isolation, air pollution and vision loss in later life (>65 years) [15] along with unhealthy diet [9] are all recognized as important modifiable risk factors. Impact modelling makes a compelling case for implementing large-scale risk reduction initiatives. In Australia, effective interventions producing a 5% per year decrease in dementia incidence are estimated to result in 261,000 fewer cases and over $120 billion in savings by 2056 [20]. In Canada, interventions that delay the average onset of dementia by even one year are estimated to result in half a million fewer cases by 2050 [21].

Over half (58%) of member countries of the Organisation for Economic Co-operation and Development (OECD) have developed national dementia strategies or action plans [22]. However, few have implemented population-level risk reduction initiatives, and these tend to be limited to public awareness-raising campaigns – for instance in Belgium [23], Australia [24] and the Netherlands [25]—with mixed results.

Health risk behaviours typically cluster [26] and dementia is a multifactorial disease with risk factors typically co-occurring in individuals [16, 17, 27]. One review found evidence of a compounding effect whereby the presence of three or more factors doubled an individual's risk of developing dementia [28]. Multidomain interventions that address a number of risk factors are therefore widely considered to be the most promising approach for preventing and delaying the onset of dementia [15, 27, 29–31]. Furthermore, community-based multidomain interventions have been found to reduce socioeconomic disparities in health outcomes including dementia-risk related health behaviours such as physical activity, diet and smoking [32].

Several large-scale studies have demonstrated the feasibility [30, 33–36] of multidomain dementia risk reduction interventions targeted to individuals – though these have been in mostly older (50–60+ years) and relatively high-income and educated populations. This healthy volunteer bias risks further widening inequities in dementia incidence [37] and more evidence is needed to inform targeted interventions that are effective in achieving outcomes for lower SES groups. Such interventions are part of a comprehensive response to dementia risk reduction [38] and are complementary to the upstream population-wide approaches being called for [15, 37].

Recognizing the paucity of dementia risk reduction studies targeting lower SES adults, we considered that intervention studies aimed at preventing other chronic conditions (e.g., cardiometabolic disorders and cancers) among lower SES adults would provide useful insights for dementia risk reduction, given the overlap in risk factors [2, 3]. Our aim was to examine the range, nature and effectiveness of community-based multidomain interventions targeting 'dementia-related' risk factors that have been designed for and/or tested in lower SES communities in OECD country settings. Specifically we sought to answer three key questions: 1) What are the key features and characteristics of the interventions?; 2) What impact did they have in terms of reaching the target population and achieving outcomes?; and 3) What are the key considerations for future public health interventions to address multidomain dementia risk among lower SES populations? Our findings are summarised in the context of an ongoing and urgent public health challenge faced by developed economies to address dementia incidence and health inequalities.

Methods

Given the broad conceptual boundaries of the topic, a scoping review was an appropriate method of enquiry to synthesise and report on the currently available evidence [39, 40]. The five-step protocol of scoping reviews developed by Arksey and O'Malley [40] was used to guide the process which included: 1) identifying the research question, 2) identifying relevant studies, 3) study selection, 4) charting the data, and 5) collating, summarizing and reporting the results. In addition to the descriptive summary of the data (step 5), we conducted subsequent exploratory statistical analysis to explore the associations

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between key intervention variables charted. The four-person review team (AC, HF, EL, KD) had subject expertise as well as experience in conducting reviews and statistical analysis. A librarian specializing in reviews on health topics was consulted in the development of the search strategy and a statistician was consulted in the development of the analysis plan.

The review sought to identify empirical studies with either qualitative or quantitative data published in English, and the Population, Concept and Context (PCC) framework [41] was used to guide the search strategy. The population of interest was adults (> 18 years) with lower SES meeting the definition of relative social disadvantage in one or more of the following metrics associated with health outcomes: education, income, employment, occupation [42] and/or neighbourhood [43]. Studies focusing solely on discrete lower SES subgroups experiencing major life transitions such as pregnant women, migrants and/or refugees were excluded to confine our review to studies targeting adults representative of the general lower SES population. Our concept focussed on multidomain interventions targeting and measuring health-related outcomes related to two or more of the following individually modifiable dementia-related risk factors: hearing loss, hypertension, alcohol use, obesity, smoking, depression, social isolation, physical inactivity, diabetes, and/or diet. We drew from recognized public health definitions of preventative health interventions [44] and included articles that described one or more of the following broad approaches a) health promotion - to empower and equip people to gain control over and improve their health; b) primary prevention - to reduce disease incidence by addressing risk factor prevalence; c) health behaviour / lifestyle change - to influence individual decisions and actions for improved and / or protected health; d) health education - to increase health knowledge and literacy as a driver of behaviour change, and; e) secondary prevention – to detect and treat disease early through screening, routine checks and referral. To ensure a focus on preventative interventions designed for population-wide approaches, we excluded intervention studies that focussed solely on tertiary prevention – i.e., disease management /rehabilitation intended to avoid or reduce the risk of deterioration from an established disease – and those that recruited participants on the basis of strict clinical definitions – i.e. a diagnosis of a particular chronic disease. Our context of interest included 38 OECD member countries [45], and Scotland, Northern Ireland, Wales and England (included in the United Kingdom's OECD membership). As our focus was community-based interventions, institutional or residential settings (i.e., hospitals, prisons, rehabilitation centres) were excluded from the review. Full details of the search

terms and eligibility criteria are available in Additional File 1 (part 1).

Search and review process

Medline (via PubMed), Embase (via Ovid), CINAHL and Scopus databases were used to identify relevant articles from across a broad range of disciplines including life sciences, biomedicine, nursing and allied health and social sciences. Results were limited to articles published in the last decade (2013–2023) to examine the evidence from intervention studies carried out in a contemporary social context. Using Covidence systematic review software (Veritas Health Innovation, 2024) two authors reviewed each article based on the eligibility criteria at the abstract and title screening, and the full text review stages, with several meetings held throughout the process to resolve conflicts by consensus. Figure 1 provides an overview of the article search, screening and selection process.

Data extraction and analysis

The first author extracted data from the articles using a customized Covidence template developed by the review team (additional file 1, part 2) with each extraction checked by a second reviewer. Consensus was reached through review meetings where needed. In line with scoping review convention [40], we did not assess the quality of the articles. To address the considerable variation amongst articles in the description of interventions, our analysis was guided by two internationally recognised conceptual frameworks: a) the 16 clusters of the Behaviour Change Techniques (BCT) Taxonomy devised by Michie et al. [46] and b) the World Health Organization's (WHO) four approaches to community engagement for Universal Health Coverage [47]. These frameworks are commonly used in the development of public health interventions, and informed understanding of the mechanisms that drive behaviour change within multidomain interventions (BCT Taxonomy) and classification of the level of participant engagement described in the development of interventions (WHO's four approaches to community engagement). We adapted working definitions of terms from these frameworks to categorize the relevant extracted data (see glossaries in additional file 1, part 2).

Descriptive and narrative thematic analysis was used to explore the wide range of intervention characteristics and outcomes reported. Although we were limited by the small number of heterogenous studies in our review, we subsequently undertook an exploratory statistical analysis to examine associations between our extracted variables. As shown in Table 1, we selected
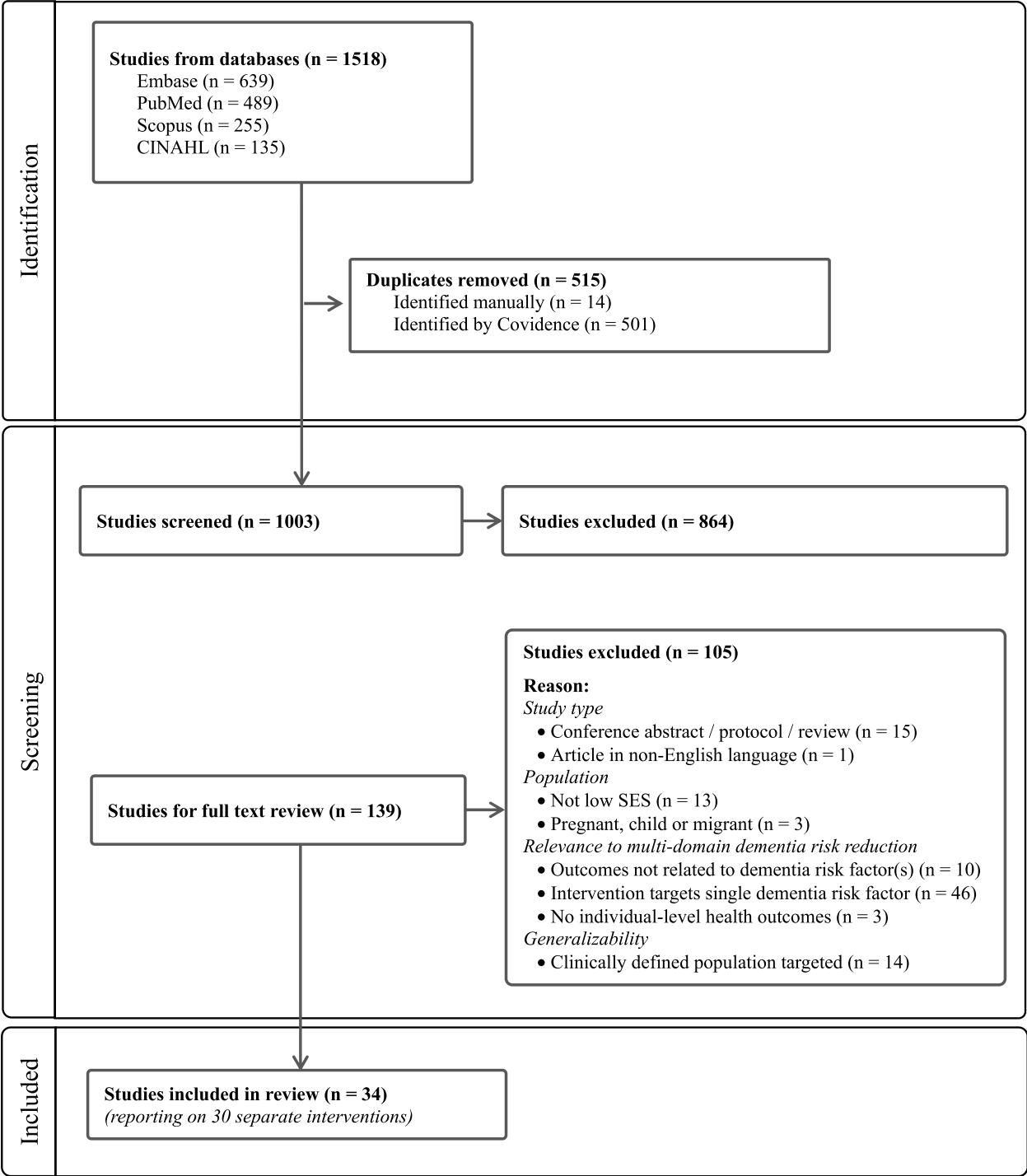
Fig. 1 Article search screening and selection process

6 categories of intervention characteristics and 2 proxies for intervention success: 1) significant intervention effect reported for at least one predetermined health or behaviour-related outcome measure at the final follow-up, and; 2) intervention retention rates. We analysed the relationship between intervention characteristics and success variables in linear regression models created in Jamovi statistical package (The Jamovi Project. 2.3 ed2022). Fitting a model for each intervention

Table 1 Variables selected for statistical analysis

Proxy variables for intervention success	Intervention characteristics
A significant intervention effect reported for at least one predetermined health or behaviour-related outcome measure at the final follow-up. (Y = 1, N = 0)[a]	Cluster 1: Population characteristics gender, ethnicity, age, SES, neighbourhood, family
	Cluster 2: Risk factors targeted 9 variables
	Cluster 3: Behaviour change technique (BCT) used 15 variables
	Cluster 4: Design / delivery features Number of. BCT clusters used Duration of active intervention Group delivery component Peer-led Reference to recognized behaviour change theory in design Incentives for participation Multiple settings options
Retention rate reported (%)	Cluster 5: Intervention duration Active intervention period Total study period (including follow-up)
	Cluster 6: Design features aimed at overcoming barriers Participatory approach used in design Incentives for participation Geographical barriers addressed Transport barriers addressed Language barriers addressed Literacy / reading barriers addressed Time barriers addressed Financial barriers addressed

[a] Treated as continuous variable for linear regression

characteristic category minimised multiple comparisons and helped to control for type 1 errors while still providing opportunity for significant relationships to be identified. Additional File 2 contains the data used for this analysis.

Results

The 30 multidomain risk reduction interventions (reported in 34 articles) targeted individual health and behavioural outcomes for more than 17,500 people with lower SES across 13 OECD countries (Table 2). Additional file, part 3 provides a comprehensive overview of data extracted for each intervention, as summarized here.

Study features: risk factors and populations targeted

The dementia-related risk factors targeted in the multidomain studies were diet (28 interventions), physical inactivity (27 interventions), obesity (22 interventions), diabetes (9 interventions), hypertension (8 interventions), smoking (6 interventions), alcohol use (6 interventions), depression (3 interventions) and social isolation (1 intervention), with no interventions directed at correcting hearing loss. We observed 15 different combinations of risk factors targeted by interventions; the most common

multidomain combination was diet, physical inactivity and obesity.

The target populations of studies reviewed had a range of different characteristics. While all interventions measured individual-level impacts on health behaviour and / or outcomes, 8 interventions targeted families (usually parent/caregiver-child dyads) and 3 targeted whole communities (interventions: #4, #24, #28). Most interventions were available to both males and females, however 3 targeted women only (interventions: #8, #13, #15) and 2 of the family-directed interventions targeted fathers and their children (interventions: #10, #11). Most interventions (67%) were available to adults of any age. While 10 interventions specified an age range for eligibility, these were broad (spanning ≥ 20-year period) and only 2 interventions were designed exclusively for older adults (> 57 years) (interventions: #17, #18).

Low socioeconomic status was characterized differently across studies using 5 main criteria of social disadvantage: participants' neighbourhood (24 interventions), income (15 interventions), health access or outcomes (11 interventions), employment or occupational status (6 interventions) and education / literacy level (6 interventions). Each of the intervention studies described at least one of these characteristics and more than half (57%) identified multiple characteristics of disadvantage in their

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Table 2 Overview of articles reviewed

Ref#	Name*(30 interventions)*	Author / year*(34 articles)*	Study design	Risk factors targeted	Country	*n*
1	Bronx Oncology Living Daily (BOLD) Healthy Living Program	Conlon et al. 2015 [48]	Single group mixed methods intervention study	diabetesdietobesity physical inactivity	US	83
2	Check-In	Kamstrup-Larsen et al. 2019 [49]	Randomized controlled trial	alcohol use depression-diabeteshypertension obesity physical inactivitysmoking	Denmark	1104
3	Conexion	Zhang et al. 2023 [50]	Randomized controlled trial	depressiondiabetes	US	134
4	Faith, Activity and Nutrition (FAN) Intervention	Wilcox et al. 2018 [51]	Randomized controlled trial	dietphysical inactivity	US	1308
		Wilcox et al. 2020 [52]	Qualitative study of an intervention			35
5	Family partners for health	Berry et al. 2017 [53]	Randomized controlled trial	dietobesity physical inactivity	US	358[φ]
6	Farm Fresh Foods for Healthy Kids (F3HK)	Seguin-Fowler et al. 2021 [54]	Randomized controlled trial	dietobesity physical inactivity	US	305[φ]
7	Feel4Diabetes	VanStappen et al. 2021 [55]	Cluster randomized controlled trial	diabetesdietobesity physical inactivity	Belgium, Finland, Greece, Spain, Hungary & Bulgaria[α]	2537[φ]
8	Full Plate Living	Joachim-Celestin et al. 2022 [56]	Single group intervention study	depressiondietobesity physical inactivity	US	98
9	Getting Our Active Lifestyles Started (GOALS)	Watson et al. 2015 [57]	Single group mixed methods intervention study	dietobesity physical inactivity	UK	143[φ]
10	Healthy Dads Healthy Kids (Australia)	Morgan et al. 2019 [58]	Single group intervention study	dietobesity physical inactivity	Australia	189[φ]
11	Healthy Dads, Healthy Kids (UK)	Griffin et al. 2019 [59]	Randomized controlled trial	dietobesity physical inactivity	UK	43[φ]
12	HeLP-GP	Parker et al. 2022 [60]	Randomized controlled trial	dietobesity physical inactivity	Australia	215
13	HeLP-her Rural	Kozica et al. 2016 [61]	Cluster randomized controlled trial	dietobesity physical inactivity	Australia	649
		Kozica et al. 2015 [62]	Single group mixed methods intervention study			190
14	MetSLIM	Bukman et al. 2017 [63]	Two-group quasi-experimental intervention study	diabetesdiethypertension obesity physical inactivity	Netherlands	220
15	My Quest	Griffin et al. 2018 [64]	Single group intervention study	dietobesity physical inactivity	US	104
16	New life, New you (NLNY)	Penn et al. 2013 [65]	Single group mixed methods intervention study	diabetesdietobesity physical inactivity	UK	218
		Penn et al. 2013 [66]	Qualitative study of an intervention			15
17	OPTIMAHL 60plus	Gallois et al. 2013 [67]	Two-group quasi-experimental intervention study	dietphysical inactivity	Germany	423
18	Physical Activity and Nutrition for Seniors (PANS) program	Burke et al. 2013 [68]	Randomized controlled trial	dietphysical inactivity	Australia	478
19	Project H.I.G.H. (Helping Individuals Get Healthy)	Suther et al. 2016 [69]	Single group intervention study	diabetesdiethypertension obesity physical inactivity	US	391
20	Simple Suppers	Hopkins et al. 2022 [70]	Two-group quasi-experimental intervention study	diet hypertensionobesity	US	109[φ]
21	SIPsmartER	Zoellner et al. 2016 [71]	Randomized controlled trial	dietobesity	US	296
22	The FAMILIA study	Fernandez-Jimenez et al. 2020 [72]	Cluster randomized controlled trial	diabetesdiethypertension obesity physical inactivitysmoking	US	635[φ]

Table 2 (continued)

Ref#	Name(30 interventions)	Author / year(34 articles)	Study design	Risk factors targeted	Country	n
23	Walk Your Heart to Health (WYHH)	Schulz et al. 2015 [73]	Cluster randomized controlled trial	diabeteshypertension obesity physical inactivity	US	695
24	Well London	Phillips et al. 2014 [74]	Cluster randomized controlled trial	dietphysical inactivitysocial isolation	UK	3886
		Derges et al. 2014 [75]	Qualitative study of an intervention			61
25	Willington Health Trainer Pilot (WHTP)	Visram, 2017 [76]	Single group mixed methods intervention study	alcohol use diethypertension obesity physical inactivity	UK	246
26	Workplace Health Promotion Program (WHPP)	VandeVen et al. 2023 [77]	Single group intervention study	alcohol use dietphysical inactivitysmoking	Netherlands	313
27	No name	Abbas et al. 2015 [78]	Single group intervention study	alcohol use diethypertension obesity physical inactivitysmoking	UK	579
28	No name	Cummins et al. 2014 [79]	Two-group quasi-experimental intervention study	dietobesity	US	1440
29	No name	Goldstein et al. 2019 [80]	Single group intervention study	alcohol use dietphysical inactivitysmoking	US	40
30	No name	Goodall et al. 2014 [81]	Randomized controlled trial	alcohol use dietphysical inactivitysmoking	UK	114

ᵃNon-OECD country

ᵠNumber denotes no. of child and caregiver diads

target population. Additional demographic indicators associated with SES were also recorded including ethnic / racial minority status (13 interventions) and residing in a regional / rural setting (8 interventions).

Targeted recruitment methods were used by all 27 studies that recruited individuals or families – usually via invitation or referral from a health professional (10 interventions), community organization (10 interventions), school (9 interventions), workplace (2 interventions) and/or member of the research team conducting the study (2 interventions). Additional passive methods (i.e. flyers, posters, social media posts, word of mouth) were used by 11 intervention studies while mass media advertising was used in one study.

Intervention design

A wide range of design features were identified among the 30 interventions. Theories of behaviour change were referenced in the design of most interventions (63%). Social cognitive theory was cited for 8 interventions while the social ecological model was cited for 3 interventions and 2 interventions cited self-determination theory. Nine other behavioural theories were cited as the basis for intervention development.

Most studies (67%) reported engaging participants in the development of interventions. This engagement ranged in intensity from the provision of information to participants about the intervention (level 1, least intensive), to empowering participants and community members to lead the development and implementation of the intervention (level 4, most intensive) [47] (see definitions in Additional file 1, Table 2c). 'Consultation and involvement' (level 2), was the most common depth of participant engagement, described in 12 interventions.

The majority of studies (90%) addressed known access barriers in the design of the intervention. The most common barriers addressed were geography (including distance to services) (16 interventions), language comprehension (8 interventions), financial (8 interventions), literacy / reading level (6 interventions), time for engagement (5 interventions), transport (3 interventions), and neighbourhood safety (2 interventions). Direct financial or other incentive / compensation (i.e. leisure centre membership) was provided for participation in almost one quarter (23%) of the interventions.

Studies described a range of behaviour change techniques (BCTs) incorporated into the design of interventions. Utilizing BCT Taxonomy [46] to classify the techniques described, we found that interventions commonly employed several technique types, including natural consequences & shaping knowledge (coded for interventions describing health education sessions) (97%), feedback and monitoring (77%), repetition & substitution (76%), goals & planning (60%) and social

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support (53%). Illustrative examples of BCTs used in practice are presented in Table 3.

Delivery and implementation

Interventions differed in terms of modes and methods of delivery and implementation. The median period of exposure to the intervention (i.e., 'active' intervention period) was 4.2 months (ranging from 1 week—2 years) while the median study duration (from implementation to final outcome measurement) was 10.6 months (ranging from 1 month—3.5 years). Sixteen studies continued to follow participants up beyond the active intervention period for an average of 27.1 weeks (6.3 months).

Most interventions (93%) included a component of in-person delivery with 70% of these designed to be delivered exclusively in-person, although two allowed for elements of the intervention to be delivered remotely (via telephone), based on participant preferences (interventions: #29, #30). Most (71%) utilized group sessions for in-person delivery of program elements. Two interventions (interventions: #15, #18) were delivered fully remotely—online and via telephone calls or text messages, while a further 8 interventions were designed to be delivered through hybrid face-to-face and remote methods.

Almost half of the interventions (47%) provided multiple locations for the delivery of in-person sessions. Community venues including churches, workplaces, schools, leisure centres, parks and other non-health venues were most common (70% of interventions) while 8 interventions (27%) used primary care centres, and 4 interventions offered components of the intervention in the participant's own home.

While most interventions (77%) were delivered by field experts (i.e. researchers, health workers) or trained project staff, almost one quarter (23%) used a peer-led approach involving specially trained community members such as church leaders (intervention: #4), community health workers (intervention: #8), community health ambassadors (intervention: #19), peer leaders and co-leaders (intervention: #22), community health promoters (intervention: #23), community volunteers (intervention: #24) and peer lay health workers (intervention: #30).

Intervention outcomes

All interventions measured health behaviour change outcomes (e.g., self-reported and/or monitored instances of performing health behaviours) and most (73%) also measured biometric health outcomes. Seventeen interventions used additional health-related outcome indicators such as self-reported health status, knowledge, attitudes, skills and/or self-efficacy for health behaviour change and access to services. At final follow-up, around two thirds (63%) of all interventions recorded significant improvements in at least one health risk related behaviour while a similar proportion (61%) of interventions measuring biometric health indicators reported significant improvement in at least one measure. Even when excluding studies with positive outcomes but low statistical power, over one-third of interventions achieved significant reduction in all risk factors targeted (Table 4). However, the success rate for individual risk factors was modest; 50% for interventions addressing hypertension and obesity, 44% for physical inactivity, 43% for diet, 33% for depression, alcohol and diabetes, and 0% for smoking and social isolation (Table 4).

Linear regression modelling examining the association between clusters of intervention characteristics and outcomes (Table 1) identified a significant positive association between the use of a wider range of different behaviour change techniques (BCTs) and reporting of significant intervention effects (mean = 4.3 BCTs used for interventions with no significant effects compared to 5.5 BCTs with significant effects, $p = 0.032$). This association was present even when controlling for other intervention design features, including having a theoretical basis ($p = 0.397$), duration ($p = 0.626$), group delivery ($p = 0.982$), options of multiple intervention sites ($p = 0.282$), peer led models ($p = 0.932$) and incentives for participation ($p = 0.057$). No other statistically significant associations were found which would help in explaining or predicting intervention effects (additional file 1, part 4).

Given the challenges in recruiting and retaining low socioeconomic groups in research [82] we considered 'reach' as an important outcome for analysis. Nine intervention studies reported low recruitment / uptake, and 4 interventions recruited participants with higher levels of socioeconomic status compared to their target population. Most (77.5%) interventions available to either gender recruited predominantly females with only one study (intervention: #26) based in a male-dominated workplace recruiting 84% males. Overall retention rates ranged from 45.5% to 87.5% (mean 69.7%, SD = 11.9) with 8 studies reporting relatively low retention rates of < 70%. While 7 studies did not report on retention, exploratory statistics using available data revealed no positive correlation between intervention duration and retention rates – nor did addressing barriers, using participatory design approaches, or incentives appear to positively influence retention in this group of studies (additional file 1, part 4).

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Table 3 Utilization of behaviour change techniques (BCT) [46] by interventions with illustrative examples

Interventions utilizing BCT	Illustrative examples
Natural consequences & shaping knowledge 29 (97%) interventions (# 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30)	**Intervention #3 – Conexion** Participants were introduced to an online diabetes and depression learning resource known as 'Conexion' and then asked to complete 2–4 modules as homework **Intervention #11—Healthy Dads, Healthy Kids (UK)** The intervention comprised 9 weekly sessions which included 30 min of education delivered for children and fathers separately. Fathers' sessions covered a range of lifestyle behaviours around the importance of physical activity, nutrition and parenting. Children were taught about healthy eating, physical activity and how to be a supportive family member
Feedback & monitoring 23 (77%) interventions (# 1, 2, 3, 5, 7, 8, 9, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 25, 26, 27, 29, 30)	**Intervention #22—The FAMILIA study** Participants received individualized counselling session to discuss the results of a cardiovascular disease risk assessment and guidance on interpreting results (including weight, waist and hip circumferences, blood pressure, blood glucose, body mass index, lipid profile, ultrasound of their carotid and/or femoral vessels). They also received a representative printed picture of their carotid and/or femoral vessels
Repetition & substitution 20 (67%) interventions (# 1, 5, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 26, 29, 30)	**Intervention #5—Family partners for health** To reduce sedentary behaviour and increase physical activity, children and parents in the intervention were asked to incrementally increase their daily step count to 10,000
Goals & planning 18 (60%) interventions (# 1, 5, 7, 8, 9, 10, 12, 13, 15, 16, 18, 19, 20, 21, 22, 26, 29, 30)	**Intervention #13—HeLP-her Rural** Through group work and 1:1 coaching, facilitators of a weight management program for rural women utilized motivational interviewing techniques with the aim to improve participants' self-management capacity through the development of skills in goal setting, problem solving, and relapse prevention
Social support 16 (53%) interventions (# 1, 4, 5, 6, 7, 8, 9, 10, 11, 14, 16, 19, 20, 22, 23, 24)	**Intervention #1—Bronx Oncology Living Daily (BOLD) Healthy Living Program** The intervention, aimed at addressing lifestyle behaviours for diabetes prevention, employed a buddy system in which participants in the education sessions formed pairs to increase personal accountability and motivation during the week. Final session included a celebration with their invited family and guests
Antecedents 11 (37%) interventions (# 4, 6, 7, 8, 9, 10, 19, 24, 26, 28, 29)	**Intervention #28—No name** Residents of the intervention neighbourhood received new full-service food retail provision (one new 41,000 square foot grocery store)
Comparison of behaviour 9 (30%) interventions (# 7, 9, 10, 11, 16, 20, 22, 23, 24)	**Intervention #10—Healthy Dads Healthy Kids (Australia)** Fathers attended eight face-to-face sessions over 3 months (90 min each) with the aim to help them achieve their weight loss goals, become healthy role models, and promote healthy behaviours for their children. It was assumed that by including the children in sessions, their natural enthusiasm for father-child activity provided an important behavioural reinforcement
Regulation 5 (17%) interventions (# 5, 7, 8, 19, 29)	**Intervention #19—Project H.I.G.H. (Helping Individuals Get Healthy),** A home-based intervention involving participants and their families aimed to improve self-care behaviours for people at risk of diabetes and cardiovascular disease, focussed on enhanced understanding of the emotional aspects of diabetes or cardiovascular disease and the impact on self-care and prevention. This approach recognized the need for support to manage negative emotions to facilitate behaviour change and where needed participants were referred to external services, including mental health counselling
Identity 5 (17%) interventions (# 4, 8, 10, 20, 29)	**Intervention #4—Faith, Activity and Nutrition (FAN) Intervention** The training emphasized the scriptural relevance of physical health from a Christian tradition. Church committee members each received a pedometer and were encouraged to identify as a role model for health behaviour to the congregation

Table 3 (continued)

Interventions utilizing BCT	Illustrative examples
Self-belief 5 (17%) interventions (# 7, 9, 10, 29, 30)	**Intervention #29—No name** An intervention addressing health risk behaviours in adults with a history of adverse childhood experiences utilized motivational interviewing to support participants to identify risk behaviours and their goals for change. During interviews, participants were guided to recall past accomplishments and the qualities that made those changes possible, as a way to highlight their resilience and inherent strengths
Associations 4 (13%) interventions (# 9, 10, 20, 29)	**Intervention #9—Getting Our Active Lifestyles Started (GOALS)** An intervention aimed at supporting families to eat healthier utilized classroom-based sessions to address prompts for over-eating, including topics such as hunger and craving and dealing with bullying
Reward & threat 3 (10%) interventions (# 9, 16, 22)	**Intervention #16—New life, New you (NLNY)** At the end of the 10-week programme, participants who had completed > 80% attendance received an access to leisure card that enabled free leisure service use for 12 months
Comparison of outcomes 2 (7%) interventions (# 8, 29)	**Intervention #8—Full Plate Living** A community health worker led intervention aimed to support participants in making balanced and realistic decisions concerning food choices. To avoid eliminating foods associated with positive emotions or cultural traditions, no food category was prohibited. Instead, participants were encouraged to thoughtfully fill three quarters of their plates with low-glycaemic index, fibre-rich foods to create or complement favourite dishes
Scheduled consequences 1 (3%) interventions (# 16)	**Intervention #16—New life, New you (NLNY)** During weight reduction sessions, trainers introduced the use of contingent rewards as one of the behaviour change strategies

Discussion

This scoping review was conducted to identify and synthesise available evidence concerning multidomain dementia-related risk reduction interventions implemented in lower SES sub-populations of OECD countries. Furthermore, we aimed to identify key considerations to inform future dementia risk reduction efforts for this high priority group.

What interventions have been studied?

Among the range of relevant interventions identified in the literature, none were designed with the goal of dementia risk reduction. Eight aimed to prevent cardiovascular disease while 5 interventions set out to improve overall physical and/or mental health and/or quality of life. The absence of any targeted interventions to reduce dementia risk among lower SES groups suggests a lag in prevention efforts in developed economies when compared to other chronic diseases.

All the targeted risk factors appeared in at least one study except for hearing loss. However, the focus was heavily skewed towards cardiometabolic risk factors. Unhealthy diet, physical inactivity and obesity were most frequently targeted – often in combination. This focus is justified given the significant evidence pointing to the prevalence and earlier development of obesity, and the clustering of associated risk behaviours among lower SES groups [83–85]. There was limited evidence (4 studies) of interventions addressing psychosocial dementia risk factors including depression, social isolation and hearing loss, and only one intervention (targeting depression) reported significant effects. This knowledge gap regarding psychosocial risk factors is problematic for informing a holistic and comprehensive multidomain approach for dementia risk reduction. Not only are these risks in themselves, but social isolation (which can be significantly exacerbated by hearing loss), depression and socioeconomic deprivation often co-exist and collectively tend to negatively impact on other health risk behaviours [86].

The mean age of participants (46.5 years) in these studies is younger than interventions typically targeting dementia risk reduction [30, 35]. Defining an optimal age for targeted, multidomain dementia risk reduction interventions is complex due to the age-dependent association of risk factors [31] and the lag in time between risk factor exposure and dementia onset [87]. The latest Lancet Commission Review (2024) [15], has associated the majority of risk factors with midlife, and there is mounting clinical and epidemiological evidence indicating that dementia pathology may develop well before symptoms appear – perhaps decades earlier [17]. This all supports the need for earlier risk reduction efforts targeted to young or middle-aged adults to delay the onset

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Table 4 Intervention effects by risk factor

Intervention	hearing loss	social isolation	depression	alcohol use	smoking	hypertension	diabetes	obesity	physical inactivity	diet
1. Bronx Oncology Living Daily (BOLD) Healthy Living Program (Conlon et al. 2015) [48]							b	b	b	b
2. Check-In (Kamstrup-Larsen et al. 2019) [49]			a	a	a	a	a	a	a	a
3. Conexion (Zhang et al. 2023) [50]			b		a	a	b			a
4. Faith, Activity and Nutrition (FAN) Intervention (Wilcox et al. 2018; Wilcox et al. 2020) [51, 52]								a	a	a
5. Family partners for health (Berry et al. 2017) [53]								d	d	d
6. Farm Fresh Foods for Healthy Kids (F3HK) (Seguin-Fowler et al. 2021) [54]								a	a	c
7. Feel4Diabetes (VanStappen et al. 2021) [55]							a	b	b	b
8. Full Plate Living (Joachim-Celestin et al. 2022) [56]			d					d	d	d
9. Getting Our Active Lifestyles Started (GOALS) (Watson et al. 2015) [57]								a	d	d
10. Healthy Dads Healthy Kids (Australia) (Morgan et al. 2019) [58]								d	d	d
11. Healthy Dads, Healthy Kids (UK) (Griffin et al. 2019) [59]								b	a	a
12. HeLP-GP (Parker et al. 2022) [60]								a	a	c
13. HeLP-her Rural (Kozica et al. 2016; Kozica et al. 2015) [61, 62]								d	d	d
14. MetSLIM (Bukman et al. 2017) [63]						a	a	d	a	d
15. My Quest (Griffin et al. 2018) [64]								d	d	d
16. New life, New you (NLNY) (Penn et al. 2013; Penn et al. 2013) [65, 66]							d	d	d	d
17. OPTIMAHL 60plus (Gallois et al. 2013) [67]								a	a	a
18. Physical Activity and Nutrition for Seniors (PANS) program (Burke et al. 2013) [68]								d	d	d
19. Project H.I.G.H. (Helping Individuals Get Healthy) (Suther et al. 2016) [69]						d	d	d	d	d
20. Simple Suppers (Hopkins et al. 2022) [70]						b		b		b
21. SIPsmartER (Zoellner et al. 2016) [71]								b		b
22. The FAMILIA study (Fernandez-Jimenez et al. 2020) [72]					a	a	a	a	a	a
23. Walk Your Heart to Health (WYHH) (Schulz et al. 2015) [73]						d	d	d	d	
24. Well London (Phillips et al. 2014; Derges et al. 2014) [74, 75]		a						a	a	a
25. Willington Health Trainer Pilot (WHTP) (Visram, 2017) [76]				d		d	d	d	d	d

Table 4 (continued)

Intervention	hearing loss	social isolation	depression	alcohol use	smoking	hypertension	diabetes	obesity	physical inactivity	diet
26. Workplace Health Promotion Program (WHPP) (VandeVen et al. 2023) [77]				*a*	*b*				*a*	*a*
27. No name (Abbas et al. 2015) [78]				*d*	*a*	*d*		*d*	*d*	*d*
28. No name (Cummins et al. 2014) [79]					*a*			*a*		*a*
29. No name (Goldstein et al. 2019) [80]				*c*	*a*				*a*	*c*
30. No name (Goodall et al. 2014) [81]				*a*	*a*				*a*	*a*

a = risk factor targeted but no positive outcomes reported

b = significant positive effect but interpret cautiously due to small sample size

c = significant short-term effect but not sustained at follow-up

d = significant effect at final data collection point

of dementia [15], - especially with respect to cardiovascular disease risk factors [27] and especially among lower SES groups given their greater burden of risk factors and earlier onset of dementia [8–11].

Our review highlights that it is possible to engage lower SES adults at younger and middle ages in interventions to reduce their 'dementia related' risk. However, it is currently unclear whether dementia risk reduction per se has salience for this demographic compared to cardiovascular disease prevention and other more proximal goals like losing weight. Recognizing that individual capabilities and motivations are key psychological factors in the majority health behaviour change theory [88], devising dementia risk reduction goals and strategies suited lower SES adults therefore needs to be informed by an understanding of their knowledge, attitudes and motivations about the condition. Messaging focussed on the protection of brain health across the life course [89], versus dementia risk reduction, may also be considered for broader appeal — especially in younger adults.

What was the impact on reach and outcomes – and why?
Complex, community-based, multidomain health interventions targeting lower SES groups are typically difficult to implement [90, 91]. Despite this, our review found that most (63%) achieved significant improvements in some health behaviours and two reported influencing behaviours among participants' wider social circles (interventions: #13, #25). The broader reach of health initiatives through social networks aligns to behavioural theory [92] and has been previously demonstrated in practice—including in dementia risk reduction interventions [93].

While a wide range of potential intervention features and approaches were identified, the factors contributing to intervention effects—or 'keys to success'—remain unclear. Our analysis found that the use of a more diverse range of behaviour change techniques (BCTs) was significantly associated with positive intervention effects, however the use of multiple techniques did not guarantee success. In line with findings of a review of interventions targeting lower SES adults by van den Bekerom et al. [94], we noted the frequent use of BCTs related to health education, goals and planning and social support. However, we found comparably lower use of BCTs related to antecedents (i.e., restructuring the physical environment) and rewards and threats (i.e., material rewards) in our review. While health education was a feature of all except one intervention in our review, it was always employed in combination with other BCTs – perhaps reflecting an understanding that changing health risk behaviour—especially within lower SES groups [95]—often requires more than just having knowledge about the risks and what to do about them [96]. Our finding that no specific

BCT produced comparably better results suggests that effective interventions may have simply adopted a combination of techniques suited to the needs of their specific target population and points to the need previously identified [94] for greater insight into the effectiveness of BCTs for different SES groups.

A number of studies failed to achieve their intended outcomes, including three (interventions: #6, #12, #29) in which short term behaviour changes achieved were not sustained at follow-up – a common limitation in behaviour change interventions [97, 98]. Several studies reported a 'ceiling effect' as a potential reason for limited health outcomes noting that the study population at baseline was healthier than expected (interventions: #6, #18, #21, #22, #27). Though it is assumed that lower SES populations would have high rates of risk factors, stipulating the presence of these factors in their eligibility criteria for participation – as almost half (47%) of the interventions did – could be an important consideration for reaching the populations most likely to benefit from interventions. Conversely, some studies reported a higher-than-expected level of morbidity in their study population as a factor for lower intervention effects (intervention: #19) and higher rates of attrition (interventions: #10, #15). This suggests that these interventions may have been less appropriate for—or acceptable to—relatively higher risk individuals. A detailed understanding of the presence and severity of health risks and behaviours in the target population is needed to design and tailor dementia risk reduction interventions that will reach, retain and support behaviour change among high-risk lower SES groups. A number of validated dementia risk assessment tools exist [99–101] that could be used to help characterise and quantify individual risk, and related behaviours as part of a tailored design approach.

Non-representative recruitment may have also biased intervention outcomes reported by some studies in our review. The under-representation of men is consistent with prior findings that women tend to be more active in health improvement programs [102, 103]. If gender disparities persist in dementia risk reduction strategies, the result may actually be a narrowing of sex differences in risk factors (i.e., obesity and diabetes) [104] and Alzheimer's disease [105] which disproportionately affects women. Nevertheless, it remains crucial to develop gender sensitive strategies for engaging higher risk lower SES men in health promotion [106] – including in dementia risk reduction.

While most (87%) interventions attracted participants who met socioeconomic criteria, few included objective measures of lower SES as an inclusion criteria for study participation. The approaches used by studies were consistent with recommendations made in the literature for

reaching hard-to-reach groups and included recruitment via known community-based services such as schools and primary care centres and the use of peer-leaders and incentives [82].

Low retention was a challenge in over one quarter (27%) of studies and, along with sub-optimal attendance, was said to have impacted on intervention intensity and a lack of significant outcomes (interventions: #2, #6, #21, #30). Lacking the time and support needed to engage in interventions due to work, family or other competing commitments and/or worries was considered a challenge by several studies (interventions: #1, #11, #14, #27, #29, #30) but only verified through actual participant feedback in two (interventions #11, #14). As previous studies have found [107], age was also a factor affecting engagement and retention. Being of younger working age was associated with higher attrition in one study (intervention #15), and several other studies found that being retired was significantly associated with greater attendance (intervention #1) and retention (intervention #30). These challenges were present despite considerable efforts reported to maximise retention in the design and delivery of interventions – for instance, by having flexible options for delivery setting and mode (online v face to face) and by actively removing multiple barriers (e.g. geographical, financial, language) that are commonly faced by lower SES groups [108].

These findings suggest that designing interventions that are effective, accessible and acceptable to a lower SES population may need to be informed by a more granular understanding of their unique needs, desires and barriers. While most interventions reported some engagement with participants / stakeholders in the development of interventions, relatively few (7 interventions) described using in-depth participatory approaches at the level of WHO level 3—'collaborating' and level 4—'empowering'. Yet, despite using more in-depth participatory approaches, only 2 of these interventions (interventions: #8, #16) managed to achieve significant intervention effects with high rates of retention. This perhaps points to the dual challenge that these complex interventions face in changing health behaviours [96] and reaching lower SES populations in health research [82, 108].

Limitations

Our scoping review with exploratory statistical analysis had several limitations that made it difficult to identify a definitive set of considerations for designing interventions with optimal effect. Firstly, we identified relatively few articles (34 studies covering 30 interventions) specifically targeting lower SES groups with relevant multidomain interventions and there was considerable heterogeneity in intervention design and delivery within these studies. This resulted in relatively few observations and limited our ability to definitively identify intervention elements that were associated with successful outcomes. We found 12 distinct behaviour change theories were cited as the basis for interventions and as reported in previous studies, there was a general lack of consistency in the description and level of detail used to describe intervention elements – and their linkage to theory [46, 91, 94]. Another key limitation is the relatively short intervention and follow-up period of the studies. This is particularly relevant for dementia risk reduction in younger/ middle-aged adults, as sustained lifestyle changes and long-term follow-up will be needed to observe effects. Furthermore, our findings are generalizable only to OECD country contexts. Addressing dementia risk factors in low- and middle-income countries warrants a separate focus given the contextual nature of socioeconomic deprivation and its association with health risks [109]. For instance, relative poverty in one of the poorest countries may be associated with poor nutrition and underweight, while in a developed country, relative poverty is often associated with a higher risk of obesity [110].

Key considerations for future action

Designing and implementing effective and age-appropriate multidomain dementia risk reduction interventions for lower SES groups is likely to be a complex challenge. Therefore, strategies will need to be informed by the specific needs of the target group, in context. To facilitate this, we propose a structured participatory approach (ABCDE-P), supported by relevant translational research / implementation science tools to: a) assess the presence, severity & clustering of dementia risk factors; b) prioritize behaviours and define the goal(s) of behaviour change; c) investigate the context for target populations' behaviours; d) develop strategies to facilitate behaviour change based on an understanding of the mechanisms of action, and; e) test and evaluate solutions to build evidence (Fig. 2). Effective multidomain risk reduction efforts are likely to bring wider benefits beyond reducing the risk of dementia given that the majority of all morbidity and mortality is due to these modifiable behavioural health risks [111].

Conclusion

Our review of dementia risk-related community-based interventions in OECD countries uniquely focussed on adults of any age with lower socioeconomic status. These interventions mostly targeted the cardiometabolic group of risk factors using a range of design and delivery
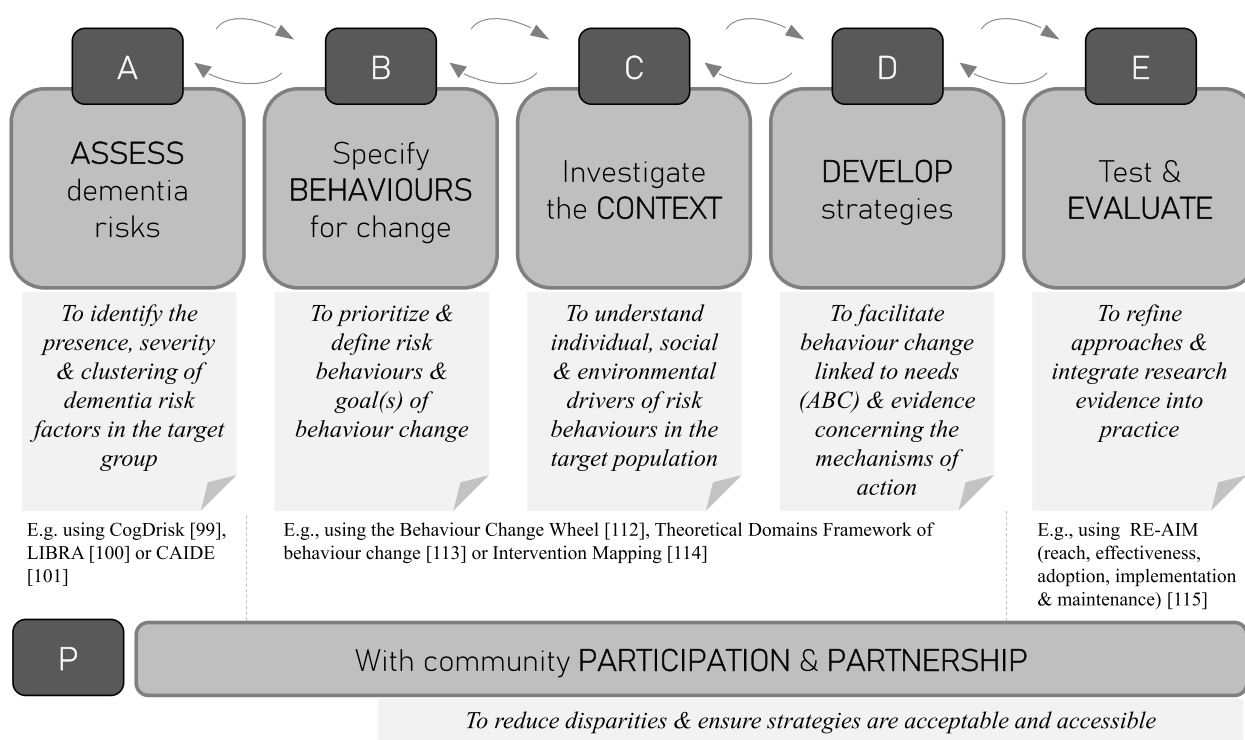
Fig. 2 ABCDE-P: An iterative design approach for developing multidomain dementia risk reduction interventions targeting lower SES groups [99–101, 112–115]

approaches – and they mostly reached women. We identified that further research is needed to guide the selection of behaviour change techniques most suited to lower SES adults as well as to determine the best approaches for addressing psychosocial dementia risk factors and for reaching men. While early and age-dependant targeting of risk factors is needed, further exploration of the salience and motivation for dementia risk reduction among lower SES and younger adults is needed.

While positive intervention effects were identified in most studies, these mixed results support the evidence pointing to a need for more urgent upstream population-wide policy and regulatory action in OECD countries to address dementia risks and health inequalities [15, 116, 117]. Such interventions rely less on individual capabilities and and resources as pre-requisites for behaviour change and therefore can improve equity in dementia risk reduction across socioeconomic groups [37]. At the same time, targeted interventions for high-risk groups are still needed and should be developed with a high degree of contextual specificity. To facilitate this, we have proposed a structured, iterative and participatory design approach for developing multidomain dementia risk reduction interventions targeting lower SES groups.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12939-025-02386-6.

Additional file 1. Part 1 – Search terms and eligibility criteria. Part 2 – Variables for extraction with relevant descriptions and glossaries. Part 3 – Extracted data for analysis. Part 4 – Summary of results from exploratory statistical analysis.

Additional file 2. Data file used for statistical analysis.

Authors' contributions

Conceptualization, methodology and screening, AC, HF and KD; data extraction, all authors; analysis AC and HF; writing— original draft preparation, AC; writing—review and editing, HF, KD, EL. All authors have read and agreed to the published version of the manuscript.

Data availability

No datasets were generated or analysed during the current study.

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Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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* Indicates references additionally cited in Additional File 1

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