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Review

Community-based physical activity and nutrition interventions in low-income and/or rural older adults: A scoping review

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ABSTRACT

The objective of this review was to identify evidence-based, community-based physical activity (PA) and nutrition-based programs aimed at facilitating health behaviour change among low-income older adults and/or those living in rural/remote areas. This review followed the scoping review methodology proposed by Arksey & O'Malley. The Michie behaviour change wheel was used to categorize intervention types. Of the 2954 retrieved citations, 25 articles met the inclusion criteria. All study interventions demonstrated positive outcomes, including improvements in fruit and vegetable consumption, PA levels, physical function and nutrition knowledge. Study findings highlight that PA and nutrition-based interventions can be effective to facilitate behavior change in low-income and/or rural older adults. Limited research exists looking specifically at older adults living in rural communities, with only two of the 25 included articles including rural study populations.

1. Background

Population aging is accelerating at a rapid rate with those over the age of 65 expected to reach 2 billion by the year 2050 [1,2]. Aging is associated with health complications, including an increased risk of developing chronic diseases and declines in functional capacity [3]. Older adults are also at an increased risk of frailty, which leads to a decreased capacity to tolerate minor stressors, increased vulnerability to adverse health outcomes, and impairment in multiple physiological systems [1]. Promoting healthy aging and decreasing the risk of disease/frailty is crucial to minimize complexity and vulnerability in an aging population. Facilitating positive health behaviour changes, such as improving nutrition and physical activity (PA), in older adults may be an effective way of achieving this goal. PA in older adults is associated with a variety of health benefits, including decreased cardiovascular mortality [4], improved physical function and quality of life [5], and decreased prevalence of common chronic conditions [6]. A meta-analysis conducted by Sun and colleagues also demonstrated that behaviour change interventions focused on PA are effective at reducing fall risk in older adults, with an intervention duration of more than five weeks and a duration of more than 32 weeks being most effective [7]. Older adults are also at an increased risk of malnutrition and diet-related deficiencies, which has implications for health, quality of life, and independence [8]. Behaviour change resulting in improvements in nutrition for older adults are known to be beneficial, including the prevention of age-related diseases/conditions [8].

PA and nutrition programs over the past decade have focused primarily on urban populations, but there is a need to expand these to populations such as rural and low-income. Among OECD countries, approximately 12.5% of older adults live in poverty, a rate higher than the general population [9]. With regard to rural populations, these tend to be an older demographic than urban populations [10]. Moreover, significant proportions of older adults live in rural areas. For example, in Canada it has been reported that 23.2% of older adults live in rural and remote communities [11]. Older adults who fall into these categories are more vulnerable and have limited access to health promoting interventions that can help reduce the risk of disease. Research suggests that people in lower socioeconomic positions have higher prevalence rates of frailty, which makes targeting this population increasingly important [12]. Additionally, older adults with lower income experience unmet needs such as food insecurity [13], lower levels of PA [14], and increased likelihood of depression [13]. Evidence from the United States and Africa also suggest that older adults living in rural communities are at heightened risk of developing non-communicable diseases, chronic diseases, and experience significantly higher rates of mortality compared to those living in urban areas [3,15]. Older adults living in rural areas have been shown to have higher physical inactivity and food insecurity compared to those living in suburban areas [16]. The need for supportive health services for the older adult population is increasing, especially in low-income and/or rural/remote areas, drawing attention to the importance of implementing strategies to enhance and support their overall health and well-being.

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This scoping review seeks to identify evidence-based, community-based PA and nutrition-based programs aimed at facilitating health behaviour change among low-income older adults and/or those living in rural/remote areas.

2. Methods

This review follows the scoping review methodology of Arksey and O'Malley [17]. The aim of this review is to describe current knowledge regarding community-based PA and nutrition-based programs targeting health behaviour change among low-income and/or rural/remote older adults. The stages of the review 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 [17]. PA is defined as all movement including during leisure time, for transport to get to and from places, or as part of a person's work [18]. Nutrition-based programs are defined as those focused on providing or obtaining the food necessary for health and growth [19]. The research question that this review aims to address is: what is the current state of the evidence regarding community-based PA and nutrition-based programs targeting health behaviour change among low-income and/or rural/remote older adults?

2.1. Identification of relevant studies

Relevant studies were identified using the following electronic research databases: Medline, Embase, PsychINFO, and CINAHL. Due to resource constraints, searches were limited to English language articles only with publication dates between 2012–2022 planning for a review of literature spanning the prior decade. Resulting citations were de-duplicated across databases and imported into Covidence, a systematic review software, (https://www.covidence.org/) for screening. Due to delays in citation review and manuscript preparation, an updated search utilizing the same search strategy was conducted in July 2024.

2.2. Study selection

Title/abstract screening and full-text screening were conducted independently and in duplicate by two study authors (EB, NB – initial search; JP, PK – updated search). Disagreements were resolved by discussion and consensus among all study authors. The following a priori inclusion criteria were applied at both screening stages: (1) the majority of study participants must have been 60 years of age or older, (2) study participants must have been identified as low-income and/or living in rural/remote areas (as defined by authors of the studies), (3) must have had an intervention that addressed PA and/or nutrition behaviours, (4) manuscript must have been published in English, and (5) have been published between January 1 2012 – July 22 2024. Studies were excluded if: (1) they failed to meet the above-mentioned inclusion criteria, (2) the study design did not include quantitative analyses (with intervention and comparator groups) of outcomes that focused on PA or nutrition behaviours (3) the full-text version was unavailable, either due to publication only abstract form or inability to retrieve the full text version. Editorials, case reports, commentaries, non-primary manuscripts and reviews were also excluded.

2.3. Charting the data

The following data were extracted from the included studies: study citation information (e.g., title, author), country, study population, intervention type, study design, outcomes, and results. PA and/or nutrition behaviour interventions were categorized according to the Michie behavior change wheel which has been used in previous reviews [20]. The Michie behavior change wheel outlines nine intervention functions that can be used to classify behavior change interventions. These nine

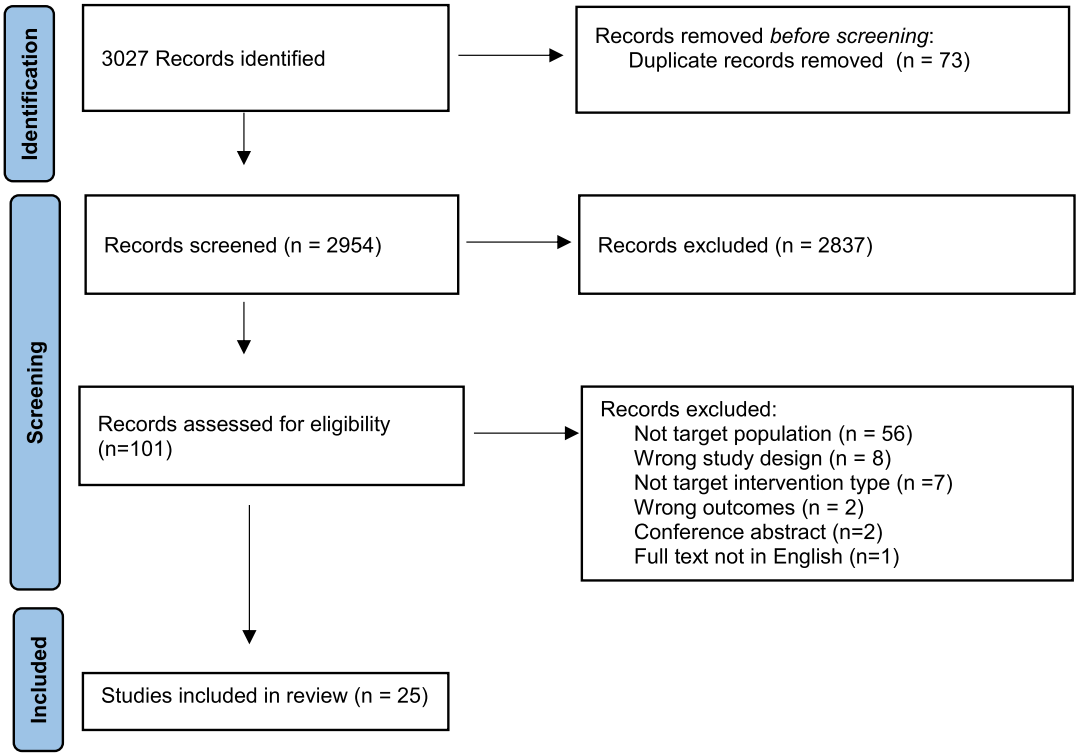

Fig. 1. PRISMA flow diagram.

Table 1
Attributes of included studies.

Author/Year	Country	Study Design	Sample Size	Age Range (mean, SD if available)	Gender % (M, F)	Low-income (Y/N) N=25	Rural/remote (Y/N) N=2	Intervention	Duration/Frequency
Bird, 2017	US	Cross-over program design	453	60–90 (74)	21, 79	Y	N	Better Choices program	1 year, 30–45 min sessions (n=4)
Crist, 2022	US	RCT	476	71	24, 76	Y	N	Peer Empowerment Program 4 Physical Activity (PEP4PA)	Group walks twice a week led by peer health coaches; Guided goal-setting and self-monitoring
Cwirlej-Sozanska, 2018	Poland	RCT	44	65–75 Intervention (67.62, 3.68); Control (67.50, 3.64)	18, 82	Y	N	Multifactorial exercise program and health education program	16 weeks, 45–60 min sessions
Geffen, 2019	South Africa	Pre-post pilot design	212	60+ (69)	25, 75	Y	N	AgeWell: Community-based peer-to-peer support program	4–5 months
Hammerback, 2012	US	RCT	89	65+	N/A	Y	N	Physical Activity for a Lifetime of Success (PALS)	1 year, 20–30 min phone calls 2x monthly (first 6 months) and 1x monthly (last 6 months)
Herens, 2016	The Netherlands	Sequential Cohort Design	268	50+ (58.6)	85, 15	Y	N	Community Based Health Enhancing Physical Activity (CBHEPA) programs	10–13 weeks
Hersey, 2015	US	QES	614	60–80	25, 75	Y	N	The Eat Smart, Live Strong (ESLS) curriculum	3 months, 45-min sessions
Jang, 2018	Korea	Designed Delay	187	65+ (77.4, 5.1)	25, 75	Y	Y	Multicomponent group exercise and nutrition supplementation program	24 weeks, 60-min sessions 2x per week
King, 2013	US	RCT	40	55+ (68.3, 8.2)	28, 72	Y	N	Virtual advisor walking program	4 months, 7 minute sessions
Luten, 2016	The Netherlands	QES	643	55+ Intervention (66.2, 7.8) Control (67, 7.8)	Intervention (39.5, 60.5) Control (43.7, 56.3)	Y	N	Groningen Lifestyle Intervention for Seniors (GLIS)	9 months
Luten, 2016	The Netherlands	QES	643	55+ Intervention (66.2, 7.8) Control (67, 7.8)	Intervention (39.5, 60.5) Control (43.7, 56.3)	Y	N	Groningen Lifestyle Intervention for Seniors (GLIS)	9 months
Manson, 2013	Canada	N/A	56	55+	19, 81	Y	N	Tai-Chi (TC) program	16 weeks, 60-min sessions 2x per week
Manson, 2013	Canada	N/A	209	50+ (68.1)	20, 80	Y	N	Tai-Chi (TC) program	16 weeks, 60-min sessions 2x per week
McClelland, 2015	US	RCT	458	60+	20, 80	Y	N	Nutritional education using song	N/A
Ryan-Ibarra, 2020	US	One-group pre-test post-test design	Max sample sizes were n43 303 pre-tests and n43 256 post-tests	All ages	N/A	Y	N	Supplemental Nutrition Assistance Program - Education (SNAP-Ed)	1–2x per month
Seo, 2016	Korea	CSS	74	70+	36, 64	Y	N	Healthy eating exploratory program (menu modification)	4 weeks
Strout, 2017	US	N/A	10	65+ (77.42)	20, 80	Y	N	Green Organic Vegetable Gardens (GROW) gardening program	17 weeks, 1 hr session 1x per week
Teixeira do Amaral, 2021	Brazil	RCT	40	65+ (68.2, 7.9)	0, 100	Y	N	Community-based exercise program (CBEP)	12 weeks, 2x per week
Toto, 2012	US	Single-group repeated-measures study	15	60+ (78.1)	0, 100	Y	N	Multicomponent exercise and physical activity program	10 weeks, 60-min sessions 2x per week
Ullevig, 2021	US	RCT	29	60+ (73.6, 8.3)	0, 100	Y	N	Daily dietary supplementation intervention	6 months
VanRavenstein, 2018	US	CSS	21	57–85	9, 91	Y	N	Otago exercise program	12 weeks, 2x per week
Wang, 2022	Canada	QES	30	74	13, 87	Y	Y	One-on-one exercise training; Nutrition education	8 weeks; 11 exercise sessions per participant; 5 online nutrition videos
Wright, 2015	US	OS	51	55+ (74.11)	33, 77	Y	N	Home-delivered meal service	2 months, 30-minute interviews (n=2)
Wu, 2022	China	CC	282	60–80	0, 100	Y	N	Social worker-led self management program	2 months, 2-hour weekly sessions (n=6)
Yang, 2016	Korea	QES	88	65–90 (72.4, 7.7)	33, 77	Y	N	Cardiovascular Disease Prevention Program (CVD-PP)	3 months, 40-min visits (n=8) with 10 min phone call (n=4)

CC, case control; CSS, cross-sectional study; F, female; M, male; N, no; N/A, not applicable; OS, observational study; QES, quasi-experimental study; SD, standard deviation; US, United States; Y, yes

Table 2
Summary findings of primary/main outcome of the selected studies.

Author/Year	Intervention Delivery	Michie Intervention Function Categorization	Relevant Outcomes Measured	Results
Bird, 2017	2 curricula (Nutrition Education & Food Resource Management); Sessions were hands-on, interactive, & delivered by educators	Education Training	(1) Increase in nutrition knowledge, (2) increase in healthy eating behaviours during the program, (3) increase in positive attitude toward money-saving strategy, and (4) intent to continue or to add desirable behaviours after conclusion of program	Participants had statistically significant knowledge improvement on the survey knowledge question: “You cannot prepare a healthy meal on a budget"; and “Beans can serve as a low cost substitute for meat in a meal”; Participants improved their behavior related to question: "How often do you use coupons or store loyalty cards to save money at the grocery store?".
Crist, 2022	Group walks twice a week led by peer health coaches; Guided goal-setting and self-monitoring	Education Enablement Modelling	Walking behaviour; Physical activity;	Intervention participants sustained roughly a 10 min/day increase in moderate to vigorous PA from baseline at all time points and increased mean quality of life scores from unsatisfied at baseline to satisfied at 12, 18 and 24 months
Cwirlej-Sozanska, 2018	Exercises were conducted by 2 physiotherapists; All activities included in the program were designed by the authors to improve the functional abilities of elderly people, with an emphasis on balance, mobility, and muscle endurance	Education Training	Mobility; PA; Physical fitness	Improvement in balance, mobility, edurance, arm/leg strength, & flexibility
Geffen, 2019	Age Well Visitors collaborated with clients to draw up a “Wellness Plan” and followed up with clients through subsequent home visits and phone calls to encourage goal achievement; Peer service providers were trained to use smartphone technology to identify evolving health problems and make referrals to primary care providers and social workers	Education	Subjective wellbeing; Emotional support; Loneliness; PA	Improvement in wellbeing, mean client social support, mood, & PA; reduction in loneliness
Hammerback, 2012	One-on-one telephone support delivered by adult volunteers who were trained in motivational interviewing	Education	PA	Improvement in PA levels
Herens, 2016	19 groups were monitored for twelve months in 7 community based health enhancing physical activity programs	Education Training	PA	No evidence to confirm hypothesis (participation in program increases leisure-time PA levels overtime); positive association between health-related quality of life outcomes, PA self-efficacy/enjoyment, & leisure-time PA is supported in multilevel regression model
Hersey, 2015	4 interactive sessions, an educator’s guide, and participant take-home materials; Intervention centers received the 4-lesson ESLS curriculum over a 4 week period, with the start dates staggered throughout the 3 month period	Education Persuasion	PA; Fruit & vegetable consumption; Food preparation behaviour	Increased daily consumption of fruit & vegetables by 0.52 cups
Jang, 2018	60-min group exercise session was held twice weekly by licensed exercise trainers at a local town hall; Participants were given a written guide for exercises and were encouraged to exercise for 60 min daily on their own; all participants received 2 125 mL nutritional supplement packs (ready to drink) per day	Education Training	Physical function; Nutrition	Improvement in physical function; Short Physical Performance Battery (SPPB) score increased 3.24 points at 12 months; Mini Nutritional Assessment-Short Form (MNASF) score improved by 1.67 points at 12 months
King, 2013	Delivered through a computer in a local community senior center; Participants were trained in the use of a simple pedometer to track daily steps and provide individualized behavioral feedback throughout the walking program; The virtual advisor sessions consisted of a salutation, individualized social dialogue, progress review based on downloaded pedometer information, and personalized feedback, problem solving, goal setting, and educational information based on current progress; Raffles of inexpensive (i.e., US$10) items took place approximately every 4 weeks	Education Incetivization	Walking behaviour	Increased amounts of walking per week (M change = 253.5 minutes)

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Table 2 (*continued*)

Author/Year	Intervention Delivery	Michie Intervention Function Categorization	Relevant Outcomes Measured	Results
Luten, 2016	Integrated community-based intervention for older adults including a local media campaign (e.g. posters, radio spots, flyers) and environmental approaches (e.g. promotion by peers and professionals and a GLIS market including local activities)	Education	PA; Fruit & vegetable consumption	Improvement in fruit & vegetable consumption in low-educated older adults; Increased trnasport-relaated PA & vegetable consumption in people with high-efficacy
Luten, 2016	The intervention consisted of: posters, radio spots, radio interviews, advertorials, newsletters, flyers, Goud Leven guide, Goud Leven website, and environmental approaches	Education Environmental restucturing	PA; Fruit & vegetable consumption	No significant change in total PA, household-related PA and fruit & vegetable consumption; increase in vegetable consumption & transport-related PA
Manson, 2013	Participants were advised to attend 2 classes per week for 16 consecutive weeks; Participants had a choice between 7 possible class times throughout the week	Education Training	Health-related fitness	Improved health-related fitness through upper & lower musculoskeletal strength
Manson, 2013	6–7 classes given throughout the week where participants were advised to attend 2 classes per week for 16 consecutive weeks	Education Training	BMI; Upper and lower body strength; Self-reported physical health	Improvement in musculoskeletal health (grip strength, arm curl in 30-second, chair stand in 30-second, 8-foot up and go test, and reach; improvement in physical functioning
McClelland, 2015	The program with song was delivered to the treatment group while the control group received the identical program except that the song was replaced with discussion over the key concepts; Posttest was administrated to both groups	Education	Nutrition knowledge	Improvement in nutrition knowledge gained: Control group (3.3), intervention group (3.8)
Ryan-Ibarra, 2020	Supplemental Nutrition Assistance Program-Education (SNAP-Ed) provides comprehensive nutrition education and obesity prevention interventions that target vulnerable populations	Education	Fruit & vegetable consumption	Improvement in fruit & vegetable consumption
Seo, 2016	The exploratory program ran in a congregate meal service center; Program involved (1) offering improved menus focusing on low salt intake, (2) education on healthy eating, and (3) a survey evaluating the effect of the exploratory program as well as in-depth interviews with foodservice providers (1 dietitian, 2 social workers, and 7 volunteer food service workers) after the program	Education Environmental restucturing	Eating behaviour (salt intake)	Reduced intake of soup, Kimchi, and salty foods
Strout, 2017	A gardening expert from the partnering university's cooperative extension led the participants in 1 hour gardening education and demonstrations weekly; Participants received 20 recipes that included vegetables	Education Environmental restucturing	Nutritional health	Increased protein intake, vegetable consumption, and water
Teixeira do Amaral, 2021	1 exercise session performed in morning and 1 in afternoon for all groups; Exercise sessions consisted of 5 min warm-up (joint mobility and stretching exercises), 20–50 min of high intensity interval training+resistance training, moderate intensity interval training+resistance training, or resistance training, and 5 min of cool- down	Education Training	Changes in anthropometric, hemodynamic, and functional capacity variables	Reduce waist circumference; Only high intensity interval training+resistance training reduced diastolic blood pressure and increased flexibility & handgrip strength
Toto, 2012	Conducted in the senior apartment building and included group exercise sessions and a home exercise program; They received a First Step to Active Health (FSAH) kit, which provided written instructions on how to begin and sustain endurance, strength, flexibility, and balance exercises; exercise hints and safety reminders; an exercise log; a medium-resistance exercise band; and a home exercise program with photographs of all exercises included in the group intervention	Education Training Enablement	PA	Increased PA, reduced activities of daily living limitations, & improved performance for endurance, strength, flexibility, & balance

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Table 2 (*continued*)

Author/Year	Intervention Delivery	Michie Intervention Function Categorization	Relevant Outcomes Measured	Results
Ullevig, 2021	Daily supplement of 25 g of dried, stabilized egg white or maltodextrin; Participants were asked to consume the entire serving of the supplement at one time; Participants were remunerated with a $50 local grocery store gift card for completing baseline and post-testing, totaling $100	Incentivization	Appendicular skeletal muscle mass; Muscle strength/function; Protein intake	Improvement in protein intake, handgrip strength, & arm curls
VanRavenstein, 2018	Participants wore Fitbit activity trackers to encourage PA outside of the group classes; Participants were trained on the use of the fitness trackers and instructed to wear them daily; Data from the trackers was downloaded and shared with each participant on a weekly basis	Training Enablement	PA	During follow-up, all participants reported they were continuing to do some exercise if not all the specific exercises they learned in the class
Wang, 2022	Participants received 11 one-on-one, tailored, physical activity training sessions from an exercise physiologist. 5 educational videos focused on nutrition were made available via a private YouTube channel.	Education Training Enablement Persuasion Environmental Restructuring Modelling	Exercise; Physical function; Nutrition	Adherence to exercise and nutrition sessions (CI) was 84% (77%–91%) and 82% (70%–93%) respectively. At program end and follow-up [mean change (CI)], significant improvements were measured in 30-second chair stand test [3.50 (1.12–5.86), 4.54 (1.94–7.13) chair stands] and dietary protein intake [12.9 (5.7–20.0), 9.2 (0.4–18.1) g]. Overall, participants were satisfied with program delivery.
Wright, 2015	Participants interviewed by phone prior to receiving their first home-delivered meal (questions pertaining to nutritional status, dietary intake, mental well-being, loneliness, and food security); Two months after meal delivery service began and the initial telephone interview, clients received a second call to collect posttest data	Training Enablement	Nutritional status; Dietary intake; Food insecurity	Calorie & protein intake increased; 41.2% of participants improved food security levels
Wu, 2022	Intervention was implemented at 10 primary health care centers; Each center organized 1 non-communicable diseases self-management group consisting of social worker group leaders and 1 health care provider consultant	Education	Exercise; Healthy eating; Self-management behaviour	Intervention group increased aerobic exercise from 86.8% to 94.8%
Yang, 2016	Personal visits by trained visiting nurses, as well as a follow-up telephone call; The visiting nurses gave the participants a health behavior checklist and offered them instructions on how to use it; The health behavior checklist was designed to record factors concerned with medication compliance, regular blood pressure monitoring, smoking cessation, exercise, diet, and stress management to encourage participants to make these important health behavior changes	Education	Health behaviour	Improvement in health behaviour, health responsibility, exercise, & stress management

BMI, body mass index; M, mean; PA, physcial activity

intervention functions are: education, persuasion, incentivization, coercion, training, environmental restructuring, modeling, restriction, and enablement [21].

3. Results

The search identified 2954 articles that underwent title/abstract screening (Fig. 1). Of the 2954 original articles, 101 studies met the criteria for full-text screening. Following full-text review, 25 articles were included. Overall, 56 studies were excluded for not focusing on the target population; eight studies had designs that did not meet the inclusion/exclusion criteria; seven studies did not focus on the target intervention; two studies did not focus on health behaviour change outcomes; two were conference abstracts; and one full-text was not in English. Table 1 outlines the characteristics of the 25 included studies. Nearly half of the studies were conducted in the United States of America (12). The remaining studies were conducted in the Netherlands (3), Korea (3), Canada (3), China (1), Poland (1), South Africa (1), and Brazil (1). The study populations consisted of older adults, with an age range between 50–85 across all studies; 16 of 25 studies included populations that were only 60+ years of age. Of the 25 studies, all included a low-income population, while only two studies included both low-income and rural participants [22,23]. The number of participants varied throughout studies from as low as 10 to as high as 643. Study designs varied. A randomized controlled trial (RCT) design was used in seven [24–30] of the 25 studies and the remainder used a variety of quasi-experimental designs. Three studies did not describe the type of study design used, and therefore were categorized as N/A in Table 1. Twelve studies [23–25,30–38] included interventions centered around increasing PA in older adults, while 14 [22,23,26–29,39–46] focused on changing nutrition/eating behavior and making additional lifestyle modifications.

Table 3
Michie behaviour change categorization.

Author/Year	Michie Behaviour Change Category								
	Education (n=21)	Training (n=10)	Enablement (n=5)	Environmental Restructuring (n=3)	Incetivisation (n=2)	Persuasion (n=2)	Coercion (n=0)	Modelling (n=2)	Restriction (n=0)
Bird, 2017	X	X							
Crist, 2022	X		X					X	
Cwirlej-Sozanska, 2018	X	X							
Geffen, 2019	X								
Hammerback, 2012	X								
Herens, 2016	X	X							
Hersey, 2015	X					X			
Jang, 2018	X	X							
King, 2013	X				X				
Luten, 2016	X								
Luten, 2016	X			X					
Manson, 2013	X	X							
Manson, 2013	X	X							
McClelland, 2015	X								
Ryan-Ibarra, 2020	X								
Seo, 2016	X			X					
Strout, 2017	X			X					
Teixeira do Amaral, 2021	X	X							
Toto, 2012	X	X	X						
Ullevig, 2021					X				
VanRavenstein, 2018		X	X						
Wang, 2022	X	X	X	X		X		X	
Wright, 2015			X						
Wu, 2022	X								
Yang, 2016	X								

The majority of studies (21 of 25) saw an improvement or increase in the study outcomes reported [22–27,29–31,33,34,36,38–46]. These outcomes included improved knowledge of healthy eating and physical activity, increased PA levels, increased consumption of fruit and vegetables, and increased protein intake. Studies focusing primarily on using PA interventions saw increases in the following: overall PA levels, balance, mobility, endurance, musculoskeletal (MSK) health, and physical function. Table 2 provides a summary of the main outcome findings of the selected studies.

With regard to categories of interventions based on the Michie behaviour change wheel, the most common type of intervention approach found in the identified studies was education, which was employed in 22 studies. The second most common category used within the studies observed was a training approach, which was present in 10 studies. A number of studies utilized a combination of education and training approaches. Education and training approaches varied from individualized sessions (e.g. personalized session with trained nurse care provider) to group sessions (e.g. twice weekly class offered to participants). Topics that were covered by education and/or training interventions included: food resource management, healthy eating behaviours, training in used of pedometers and other fitness trackers, and guidance on physical activities. Several studies made use of multi-component interventions (Table 3). The remaining approaches were included in the following number of studies: enablement (4), environmental restructuring (3), incentivization (2), modelling (2), and persuasion (1). None of the included studies utilized coercion or restriction as intervention approaches.

As mentioned, only two studies included a focus on rural older adults. The study conducted by Jang [22] included 108 adults aged 65+ participated in a multicomponent group exercise and nutrition supplementation program for 24 weeks. Participants took part in 60-min group exercise sessions held twice weekly by licensed exercise trainers at a local town hall. Study participants demonstrated improvement in both physical functioning and nutrition measures. The other study was a pilot study which included only 30 participants, some of whom lived in rural areas [23]. The intervention consisted of 11 one-on-one, tailored, physical activity training sessions from an exercise physiologist, as well as 5 educational videos focused on nutrition that were made available via a private YouTube channel. Participants showed good adherence to the 8-week intervention, as well as improved physical function and increase protein intake.

4. Discussion

This scoping review identified 25 studies focusing on facilitating physical activity and/or nutrition health behaviour change in low-income and/or rural older adults. It should be noted that only one study [22] focused specifically on rural older adults, identifying gap in the research literature on this topic, while a second included some older adults from rural areas without specific subgroup analyses [23]. Eleven of the included studies focused solely on physical activity interventions, while the remainder addressed nutrition-based interventions with, in some cases, additional lifestyle modifications. The majority of studies included interventions with an educational component. Additionally, training approaches and multi-component interventions were also common. Overall, these interventions were found to have positive health behaviours outcomes, as outlined in Table 2.

This review demonstrates that the health behavior of low-income/rural adults over the age of 60 can be positively impacted through a variety of PA and/or nutrition-focused interventions. Interventions should focus on combining education and instructional components in order to achieve optimal results for users [47,48]. Whatnall et al. [49], which focused on an 18+ study population, found that interventions providing education in combination with tailored or instructional components were more effective than education interventions alone. This is consistent with the studies of older adults included in this review, which utilized interactive educational components to increase the likelihood of seeing improvement in overall outcomes.

Evidence demonstrates that older adults are at an increased risk of malnutrition [50]. In addition, participation in regular PA and consumption of a balanced diet are key contributors to bone health in older adults [51,52]. Due to the increased risk of developing chronic health condi-

tions in older adulthood and the protective health factors of PA and nutrition, older adults are encouraged to place emphasis on improving their PA and nutrition to increase their overall well-being. A significant gap identified in this scoping review was the limited information available regarding rural older adults specifically, pointing to the fact that additional research in this area is needed. Further research assessing the effectiveness of nutrition and physical activity interventions for low income and rural individuals will build upon the findings thus far and present a more concrete conclusion of the benefits to wellbeing that may exist for this population.

There are limitations to this scoping review. Only English-language studies were included, which may have prevented additional relevant studies from being included in the analysis, however evidence suggests restricting reviews to the English language does not impact review conclusions [53]. Most interventions included in this review focused on educational approaches and did not incorporate additional intervention types that may also demonstrate improved health outcomes among this study population, such as enablement, environmental restructuring, and incentivization. Additionally, the majority of the studies were based in the United States of America which may limit their generalizability. Due to time and resource constraints, only academic databases were searched during the identification of relevant studies phase and a grey literature search was not conducted. Additionally, although we did not formally assess for study quality, most of the studies were smaller in size and non-randomized which increases the chances of study bias.

5. Conclusions

This scoping review outlines the current literature on existing PA and/or nutrition programs aimed to facilitate health behaviour change among low-income and/or rural older adults. The majority of studies focused on low-income older adults and included interventions focusing on education and training. Limited research exists looking specifically at older adults living in rural communities, as well as additional behaviour change intervention strategies. In order to identify most effective strategies for PA and/or nutrition behaviour change, further research including older adults living in rural areas is needed to ensure programs are targeting those who are at a heightened risk that may have unique needs difficulty accessing programs. With the availability of additional evidence available, more robust, comprehensive programs can be implemented that are successful at targeting vulnerable populations to generate desired changes in health behaviour.

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Conflicts of interest

All authors confirm that they have no conflicts of interest to declare.

CRediT authorship contribution statement

Elizabeth Bernard: Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Nash Brewer:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Jeanette C Prorok:** Writing – review & editing, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Perry Kim:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Data curation, Conceptualization. **John Muscedere:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Data curation, Conceptualization.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.tjfa.2025.100034.

References

[1] Kojima G, Liljas AE, Iliffe S. Frailty syndrome: implications and challenges for health care policy. Risk Manag Healthc Policy 2019:23–30.
[2] Merchant R, Morley J, Izquierdo M. Exercise, aging and frailty: guidelines for increasing function. Springer; 2021. p. 405–9.
[3] Kuo Y-L, Chou W-T, Chu C-H. Urban-rural differences in factors affecting mortality and causes of death among older adults. Geriatr Nurs (Minneap) 2022;43:151–8.
[4] Wu C-Y, Hu H-Y, Chou Y-C, Huang N, Chou Y-J, Li C-P. The association of physical activity with all-cause, cardiovascular, and cancer mortalities among older adults. Prev Med 2015;72:23–9.
[5] de Farias Camboim FE, Oliveira Nóbrega M, Barbosa Davim RM, Alves Camboim JC, Ventura Nunes RM, Ximenes Oliveira S. Benefits of physical activity in the third age for the quality of life. J Nurs UFPE/Revista de Enfermagem UFPE 2017;11(6).
[6] Musich S, Wang SS, Hawkins K, Greame C. The frequency and health benefits of physical activity for older adults. Popul Health Manag 2017;20(3):199–207.
[7] Sun M, Min L, Xu N, Huang L, Li X. The effect of exercise intervention on reducing the fall risk in older adults: a meta-analysis of randomized controlled trials. Int J Environ Res Public Health 2021;18(23):12562.
[8] Clegg ME, Williams EA. Optimizing nutrition in older people. Maturitas 2018;112:34–8.
[9] OECD Old-age income poverty. OECD Publishing; 2024. doi:101787/pension_glance-2017-en.
[10] Elliott D MM. Rural america is aging - without enough care workers. population reference bureau. https://www.prb.org/articles/rural-america-is-aging-without-enough-care-workers/#:í:text=Yet%20new%20research%20finds%20rural,them%20%E2%80%9Cage%20in%20place.%E2%80%9D.
[11] Canada S. In the midst of high job vacancies and historically low unemployment, canada faces record retirements from an aging labour force: number of seniors aged 65 and older grows six times faster than children 0–14. Statistics Canada; 2024.
[12] Hoogendijk EO, Rijnhart JJ, Kowal P, et al. Socioeconomic inequalities in frailty among older adults in six low-and middle-income countries: results from the WHO Study on global AGEing and adult health (SAGE). Maturitas 2018;115:56–63.
[13] Jung SE, Kim S, Bishop A, Hermann J. Poor nutritional status among low-income older adults: examining the interconnection between self-care capacity, food insecurity, and depression. J Acad Nutr Diet 2019;119(10):1687–94.
[14] Craike M, Bourke M, Hilland TA, et al. Correlates of physical activity among disadvantaged groups: a systematic review. Am J Prev Med 2019;57(5):700–15.
[15] Negin J, Cumming R, de Ramirez SS, Abimbola S, Sachs SE. Risk factors for non–communicable diseases among older adults in rural Africa. Trop Med Int Health 2011;16(5):640–6.
[16] Durazo E, Jones M, Wallace S, Van Arsdale J, Aydin M, Stewart C. The health status and unique health challenges or rural older adults in California, 2011.
[17] Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol 2005;8(1):19–32.
[18] Organization WH. Physical activity. https://www.who.int/news-room/fact-sheets/detail/physical-activity.
[19] Sciences NIoEH. Nutrition, Health, and your environment. National Institutes for Health. 2024. https://www.niehs.nih.gov/health/topics/nutrition.
[20] Richardson M, Khouja CL, Sutcliffe K, Thomas J. Using the theoretical domains framework and the behavioural change wheel in an overarching synthesis of systematic reviews. BMJ Open 2019;9(6):e024950.
[21] Michie S, Van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implement Sci 2011;6:1–12.
[22] Jang I-Y, Jung H-W, Park H, et al. A multicomponent frailty intervention for socioeconomically vulnerable older adults: a designed-delay study. Clin Interv Aging 2018:1799–814.
[23] Wang E, Keller H, Mourtzakis M, et al. MoveStrong at home: a feasibility study of a model for remote delivery of functional strength and balance training combined with nutrition education for older pre-frail and frail adults. Appl. Phys Nut Metabol 2022;47(12):1172–86.
[24] Cwirlej-Sozanska A, Wisniowska-Szurlej A, Wilmowska-Pietruszynska A, et al. Evaluation of the effect of 16 weeks of multifactorial exercises on the functional fitness and postural stability of a low-income elderly population. Top Geriatr Rehabil 2018;34(4):251–61.
[25] Hammerback K, Felias-Christensen G, Phelan EA. Evaluation of a telephone-based physical activity promotion program for disadvantaged older adults. Prev Chronic Dis 2012;9.
[26] King AC, Bickmore TW, Campero MI, Pruitt LA, Yin JL. Employing virtual advisors in preventive care for underserved communities: results from the COMPASS study. J Health Commun 2013;18(12):1449–64.
[27] McClelland JW, Jayaratne K, Bird C. Use of song as an effective teaching strategy for nutrition education in older adults. J Nutr Gerontol Geriatr 2015;34(1):22–33.
[28] do Amaral VT, Fernandes B, Ngomane AY, Marçal IR, de Souza Zanini G, Ciolac EG. Short-term community-based exercise programs in low-income older women: does exercise intensity and modality matters? Exp Gerontol 2021;156:111591.

[29] Ullevig SL, Zuniga K, Austin Lobitz C, Santoyo A, Yin Z. Egg protein supplementation improved upper body muscle strength and protein intake in community-dwelling older adult females who attended congregate meal sites or adult learning centers: A pilot randomized controlled trial. Nutr Health 2022;28(4):611–20.
[30] Crist K, Full KM, Linke S, et al. Health effects and cost-effectiveness of a multilevel physical activity intervention in low-income older adults; results from the PEP4PA cluster randomized controlled trial. Int J Behav Nut Phys Activity 2022;19(1):75.
[31] Geffen LN, Kelly G, Morris JN, Howard EP. Peer-to-peer support model to improve quality of life among highly vulnerable, low-income older adults in Cape Town, South Africa. BMC Geriatr 2019;19:1–12.
[32] Herens M, Bakker EJ, van Ophem J, Wagemakers A, Koelen M. Health-related quality of life, self-efficacy and enjoyment keep the socially vulnerable physically active in community-based physical activity programs: a sequential cohort study. PLoS One 2016;11(2):e0150025.
[33] Hersey JC, Cates SC, Blitstein JL, et al. Eat smart, live strong intervention increases fruit and vegetable consumption among low-income older adults. J Nutr Gerontol Geriatr 2015;34(1):66–80.
[34] Luten KA, Dijkstra A, Reijneveld SA, de Winter AF. Moderators of physical activity and healthy eating in an integrated community-based intervention for older adults. Europ J Public Health 2016;26(4):645–50.
[35] Luten KA, Reijneveld SA, Dijkstra A, de Winter AF. Reach and effectiveness of an integrated community-based intervention on physical activity and healthy eating of older adults in a socioeconomically disadvantaged community. Health Educ Res 2016;31(1):98–106.
[36] Toto PE, Raina KD, Holm MB, Schlenk EA, Rubinstein EN, Rogers JC. Outcomes of a multicomponent physical activity program for sedentary, community-dwelling older adults. J Aging Phys Act 2012;20(3):363–78.
[37] VanRavenstein K, Davis BH. When more than exercise is needed to increase chances of aging in place: qualitative analysis of a telehealth physical activity program to improve mobility in low-income older adults. JMIR Aging 2018;1(2):e11955.
[38] Wu X, Chen X, Pan B, et al. Evaluation of a social worker-led health care program for low-income elderly women: a pilot trial. J Public Health (Bangkok) 2023;31(8):1209–15.
[39] Bird CL, McClelland JW. Educating limited resource older adults for better choices to lower risk of food insecurity. Int J Consum Stud 2017;41(2):225–33.
[40] Manson J, Ritvo P, Ardern C, et al. Tai Chi's effects on health-related fitness of low-income older adults. Canadian J Aging/La Revue canad du vieill 2013;32(3):270–7.
[41] Manson J, Rotondi M, Jamnik V, Ardern C, Tamim H. Effect of tai chi on musculoskeletal health-related fitness and self-reported physical health changes in low income, multiple ethnicity mid to older adults. BMC Geriatr 2013;13:1–10.
[42] Ryan-Ibarra S, DeLisio A, Bang H, et al. The US supplemental nutrition assistance program–education improves nutrition-related behaviors. J Nutr Sci 2020;9:e44.
[43] Seo S, Kim O, Ahn J. Healthy eating exploratory program for the elderly: low salt intake in congregate meal service. J Nutr Health Aging 2016;20:316–24.
[44] Strout K, Jemison J, O'Brien L, Wihry D, Waterman T. GROW: green organic vegetable gardens to promote older adult wellness: a feasibility study. J Comm Health Nurs 2017;34(3):115–25.
[45] Wright L, Vance L, Sudduth C, Epps JB. The impact of a home-delivered meal program on nutritional risk, dietary intake, food security, loneliness, and social well-being. J Nutr Gerontol Geriatr 2015;34(2):218–27.
[46] Yang S-O, Kim S-J, Lee S-H. Effects of a South Korean community-based cardiovascular disease prevention program for low-income elderly with hypertension. J Community Health Nurs 2016;33(3):154–67.
[47] Chase J-AD. Interventions to increase physical activity among older adults: a meta–analysis. Gerontologist 2015;55(4):706–18.
[48] Taylor J, Walsh S, Kwok W, et al. A scoping review of physical activity interventions for older adults. Int J Behav Nut Phys Act 2021;18(1):82.
[49] Whatnall MC, Patterson AJ, Ashton LM, Hutchesson MJ. Effectiveness of brief nutrition interventions on dietary behaviours in adults: A systematic review. Appetite 2018;120:335–47.
[50] Fávaro-Moreira NC, Krausch-Hofmann S, Matthys C, et al. Risk factors for malnutrition in older adults: a systematic review of the literature based on longitudinal data. Adv nut 2016;7(3):507–22.
[51] Giangregorio L, Papaioannou A, Macintyre N, et al. Too fit to fracture: exercise recommendations for individuals with osteoporosis or osteoporotic vertebral fracture. Osteop Intl 2014;25:821–35.
[52] McMichan L, Dick M, Skelton DA, et al. Sedentary behaviour and bone health in older adults: a systematic review. Osteop Int 2021;32:1487–97.
[53] Dobrescu A, Nussbaumer-Streit B, Klerings I, et al. Restricting evidence syntheses of interventions to English-language publications is a viable methodological shortcut for most medical topics: a systematic review. J Clin Epidemiol 2021;137:209–17.