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Review Article

Open-Access Physical Activity Programs for Older Adults: A Pragmatic and Systematic Review

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Abstract

Background and Objectives: Open-access, community-based programs are recommended to assist older adults in meeting physical activity guidelines, but the characteristics, impact, and scalability of these programs is less understood. The Land-Grant University Cooperative Extension System, an organization providing education through county-based educators, functions as a delivery system for these programs. A systematic review was conducted to determine characteristics of effective older adult physical activity programs and the extent to which programs delivered in Extension employ these characteristics.

Research Design and Methods: A systematic review of peer-reviewed and grey literature was conducted from August 2016 to February 2017. The review was limited to open-access (available to all), community-based physical activity interventions for older adults (≥65 years of age). The peer-reviewed literature search was conducted in PubMed and EBSCOhost; the grey literature search for Extension interventions was conducted through Extension websites, Land-Grant Impacts, and the *Journal of Extension*.

Results: Sixteen peer-reviewed studies and 17 grey literature sources met inclusion criteria and were analyzed. Peer-reviewed and Extension programs were similar in their limited use of behavioral theories and group-based strategies. Compared to Extension programs, those in the peer-reviewed literature were more likely to use a combination of physical activity components and be delivered by trained professionals.

Discussion and Implications: The results indicate notable differences between peer-reviewed literature and Extension programs and present an opportunity for Extension programs to more effectively use evidence-based program characteristics, including behavioral theories and group dynamics, a combination of physical activity components, and educator/agent-trained delivery agents.

Keywords: Community-based, Intervention, Health, Exercise, Educator

Background and Objectives

The disease-preventing benefits of physical activity are well established (Durstine, Gordon, Wang, & Luo, 2013; Warburton, Nicol, & Bredin, 2006). For older adults in particular, staying physically active leads to a decreased risk of chronic diseases including heart disease, type 2 diabetes, cancer, obesity, hypertension, osteoarthritis, osteoporosis, and depression (Bauman, Merom, Bull, Buchner, & Fiatarone Singh, 2016; Durstine et al., 2013; Warburton et al., 2006). Older adults (age 65 and older) experience high rates of chronic diseases: 37% of this population has heart disease (Carroll & Miller, 2013), 25% has diabetes (American Diabetes Association, 2016), and 35% are obese (Centers for Disease Control and Prevention, 2012). By preventing these chronic diseases and slowing the progression of existing conditions, engaging in regular physical

activity can increase both overall life expectancy and active life expectancy, that is, years of life free of significant disease or disability (Chodzko-Zajko et al., 2009). Engaging in physical activity can decrease risk of falls (Bauman, Merom, Bull, Buchner, & Fiatarone Singh, 2016; Nelson et al., 2007), help older adults maintain their independence (Centers for Disease Control and Prevention, 2015), and avoid costly hospital and nursing home stays that can become life threatening (National Council on Aging, 2017).

In addition to preventing chronic diseases, physical activity is also beneficial for those who have been diagnosed with a chronic disease. Through engaging in physical activity, those with cardiovascular disease can decrease their risk of cardiac events and premature death (Warburton et al., 2006), whereas those with type 2 diabetes can better control their blood sugar levels (Warburton et al., 2006). Physical activity has been shown to be safe for these populations as long as individuals follow physicians guidelines, which may include limiting certain types of activity (Nelson et al., 2007). A physical activity plan with both therapeutic (to treat the existing condition) and preventive (to prevent other chronic conditions from developing) activities is recommended, as "virtually all older adults should be physically active" (p. 1101) (Nelson et al., 2007).

The Centers for Disease Control and Prevention (2015) recommends that older adults engage in 150 minutes of moderate-intensity aerobic activity (or 75 minutes of vigorous-intensity aerobic activity, or an equivalent combination of both) and two sessions of muscle-strengthening activities (targeting major muscle groups) per week. However, only 12% of the population fully meet these recommendations (Centers for Disease Control and Prevention, 2016), indicating a large gap between recommendations and practice. This research to practice gap leads to billions of health care dollars spent on preventable treatments for older adults. These costs may continue to rise as the number of Americans who are 65 years of age and older is expected to increase to 88.5 million by 2050 (Vincent & Velkoff, 2010). Disseminating and implementing interventions that help older adults meet recommendations is imperative to reduce rates of chronic disease and decrease health care costs; particularly through the federally funded Medicare system.

Community-based physical activity interventions are recommended by the Task Force on Community Preventive Services to help Americans increase physical activity levels (Kahn et al., 2002; Task Force on Community Preventive Services, 2002). Compared to programs implemented in traditional health care settings, community-based programs have greater access and reach (Office of Disease Prevention and Health Promotion, 2017) as they target individuals in their natural settings (social groups or geographic areas) (Brand et al., 2014). Community-based programs are especially important for older adults, as they can address the many barriers to physical activity (e.g., fatigue, existing health problems, and lack of motivation) experienced by this population while also addressing concerns of social isolation (Estabrooks, Fox, Doerksen, Bradshaw, & King, 2005; Kahn et al., 2002; Shores, West, Theriault, & Davison, 2009). Finally, as many of these programs are free or low cost, they can reach limited income populations and improve health equity. However, many evidence-based, community-based programs have restrictions based on participant eligibility (e.g., having a chronic disease) (Cheifetz et al., 2014; Phelan, Batik, Walwick, Wang, & LoGerfo, 2008) or membership requirements (e.g., YMCA) (Cheifetz et al., 2014; Petrescu-Prahova, Belza, Kohn, & Miyawaki, 2016). "Open-access" programs go one step beyond "community-based" and is operationalized as unrestricted use and available to all. This distinction is important as not all open-access programs are community-based, nor are all community-based programs open access. The key principle of open-access, community-based programs is that they are delivered in community settings and any older adult can participate, regardless of membership, residency, race, ethnicity, or chronic disease restrictions.

One delivery system for these open-access, community-based programs is the Land-Grant University Cooperative Extension System. Extension is a nationwide network of organizations that bring research-based information to residents of each state and territory through informal, community education, reaching millions of people throughout the country (U.S. Department of Agriculture, n.d.-a). Extension has not historically had a focus on physical activity programming, as it historically has roots in agriculture education and home economics. However, physical activity was recently added to the U.S. Agricultural Act of 2014 (the Farm Bill) that authorizes Extension (U.S. Department of Agriculture, 2015a), and is included in the 2014–2018 strategic plan of the National Institute of Food and Agriculture (U.S. Department of Agriculture, 2015b), which funds Extension (U.S. Department of Agriculture, n.d.-a).

Extension educators nationwide implement community-based older adult physical activity programs which, in alignment with Extension's mission, are open to the public. These programs aim to reduce chronic disease and improve quality of life by targeting a variety of outcomes, including increasing participants' physical activity levels (Traywick & Washburn, 2014; Young, 2016), improving social belonging (Sowle, Francis, Margrett, & Franke, 2016), and reducing risk of falls and fractures (Gunter & John, 2014; Houtkooper, n.d.; NDSU Extension Service, 2016; J. Strommen, personal communication, February 6, 2017; Young, 2016) The Extension system's work to implement physical activity programs is often done in silos rather than as a nationwide system; see the supplemental reference list for information on the programs being implemented across the country.

As physical activity is a relatively new programming area for Extension, educators may not have the experience or resources needed to select and adopt evidence-based programs (Peña-Purcell et al., 2012). It is unknown

if programs implemented through Extension are evidence-based, i.e., shown to be effective through at least one peer-reviewed study (National Cancer Institute and Substance Abuse and Mental Health Services Administration, 2017). Adopting evidence-based programs rather than individually developed programs ensures that programs are effective for the target population and eliminates the time required to develop a new program (Brownson, Fielding, & Maylahn, 2009; Brownson & Jones, 2009). Evidence-based programs have the potential to be more cost effective to deliver and can be more accurately evaluated (Brownson et al., 2009; Brownson & Jones, 2009).

These evidence-based physical activity interventions feature certain characteristics that lead to positive behavioral outcomes. Community-based physical activity programs recommended by the Task Force on Community Preventive Services use behavioral strategies including providing support for reaching physical activity goals, monitoring progress and encouraging activity (e.g., through phone calls), goal setting, self-monitoring, creating social support, reinforcing behavior, problem solving, and relapse prevention (Kahn et al., 2002). Most of the recommended interventions are also based on constructs from one or more health behavior change theory (e.g., Social Cognitive Theory (Bandura, 1986), Transtheoretical Model of Change (Prochaska & DiClemente, 1984), Kahn et al., 2002)). In addition, several recent reviews of physical activity interventions also found social support, use of behavior change theory, goal setting, and self-monitoring to be essential characteristics for behavior change (Greaves et al., 2010; Heath et al., 2012; Horodyska et al., 2015). Taken together, the use of health behavior theories and constructs to change physical activity behaviors is well established in the literature.

However, implementing and sustaining evidence-based programs in the intended delivery systems remains problematic. Programs are often developed and tested in research trials but never fully adopted by public health practitioners in real world settings (Brownson & Jones, 2009). There are numerous reasons for this research to practice gap, including both dissemination (the innovation, communication channels, social systems, and time; Rogers, 2003) and implementation (acceptability, adoption, appropriateness, costs, feasibility, fidelity, penetration, and sustainability (Proctor et al., 2011) factors. Furthermore, without packaging that is accessible and user-friendly, practitioners are unlikely to have the information needed to implement evidence-based programs (Wandersman et al., 2008). Systematic reviews can synthesize information on interventions for easier translation to practitioner-friendly products (Wandersman et al., 2008) for better dissemination throughout the Extension system.

Several systematic reviews that include characteristics of older adult physical activity interventions exist; however, none focus exclusively on open-access community-based programs. Conn, Minor, Burks, Rantz, and Pomeroy (2003) and Chase (2015) reviewed physical activity interventions in adults aged 65 and older that were not specifically community-based. Other reviews focused on interventions targeting only frail older adults (de Labra, Guimaraes-Pinheiro, Maseda, Lorenzo, & Millán-Calenti, 2015), were specific to the time around retirement (Baxter et al., 2016), or included older adults younger than 65 years old (Baker, Atlantis, & Fiatarone Singh, 2007; Hobbs et al., 2013; King, Rejeski, & Buchner, 1998). Moore, Warburton, O'Halloran, Shields, and Kingsley (2016) did review community-based programs; however, community-based was not defined or used as a search term, so programs were not necessarily open-access. The review was also limited to programs that took place in rural or regional settings. This demonstrates a gap in the literature related to physical activity programs that are community-based, open-access, and target adults aged 65 and older.

Therefore, the aim of this study was to systematically review both the peer-reviewed and grey literature (not formally published through academic sources; Godin, Stapleton, Kirkpatrick, Hanning, and Leatherdale (2015) related to community-based older adult physical activity promotion interventions. This review was conducted to determine the characteristics of effective older adult physical activity programs and the extent to which programs delivered in Extension systems nationwide employ these characteristics in order to increase the impact of Extension programming on older adult health.

Research Design and Methods

Procedure for Conducting Review

A systematic review was completed by searching the databases PubMed and EBSCOhost for combinations of the search terms physical activity (or fitness or exercise or strength training) and community-based (or community-wide or communitywide). (See Appendix A.) Results were restricted to older adults (aged 65 and older). Articles published before August 2016 and available in English were included. Programs were included if met all of the following: (a) had a physical activity, fitness, or exercise outcome (including subjective or objective measures); (b) were community-based/open-access (operationalized below); (c) included only participants aged 65 years or older; and (d) the article reported pre and post evaluation data.

The operational definition of community-based/open-access was based on guidelines for Extension programs, which must provide equal access to all to comply with civil rights guidelines (U.S. Department of Agriculture, n.d.-b). Therefore, program participation could not be restricted based on: membership (to a fitness center, community housing, etc.); clinical affiliation; gender, race, or ethnicity; diagnosis of health conditions (such as programs designed for those with arthritis or who have fallen in the past year). Programs that restricted participants with health conditions for safety reasons (such as those with cardiac conditions

or neurological limitations) were included. These eligibility criteria were chosen to increase generalizability of these findings as well as ensure similarity between programs identified by the review and those offered by Extension.

Older adult physical activity programs conducted in state Extension systems were identified through a systematic review of the grey literature through an adaptation of the protocols described by Godin, Stapleton, Kirkpatrick, Hanning, and Leatherdale (2015) and Mahood, Van Eerd, and Irvin (2014). First, targeted websites (Extension websites for each state and U.S. territory) were searched for any program matching our inclusion criteria by reviewing those listed in relevant program areas (e.g., Nutrition and Physical Activity, Food and Health, Healthy Living and Families, Family and Consumer Sciences). Second, two Extension-specific grey literature sites were searched. Land-Grant Impacts, a database of published reports on Extension interventions, was searched for impact statements listed under the Nutrition and Health focus area with a Physical Activity tag that contained the search terms physical activity (or fitness or exercise or strength training) and older adult (or senior). The *Journal of Extension* (*JOE*), Extension's official refereed journal, was also searched with these search terms. (See Appendix A.)

Grey literature published by August 2016 and available in English were included, and followed similar eligibility criteria as the peer-reviewed literature. Interventions that *targeted* older adults rather than interventions that included *only* participants aged 65 or older were included as Extension interventions cannot discriminate on the basis of age.

Grey literature sources that did not include pre and post data or the number of participants were further investigated. This systematic procedure was as follows: the lead author emailed the contact person for each intervention to explain the purpose of the study and request information; one follow-up email was sent after seven days without a response. If provided, the pre and post evaluation data or number of participants was included along with the original grey literature source.

Selection of Studies for Review

The initial search for peer-reviewed articles yielded 1,727 articles. The titles and abstracts of these articles were independently reviewed by two authors and 1,629 were excluded because they did not meet the inclusion criteria or were duplicates. The full text of the remaining 98 articles was assessed by two authors and an additional 82 were excluded because they did not have a physical activity outcome (n = 3), were not open-access programs (n = 35), included adults younger than 65 years old (n = 32), did not include pre and post evaluation data (n = 6), were not available in English (n = 5), or was a duplicate (n = 1). This left 16 peer-reviewed articles which met inclusion criteria for this review. (See Figure 1.)

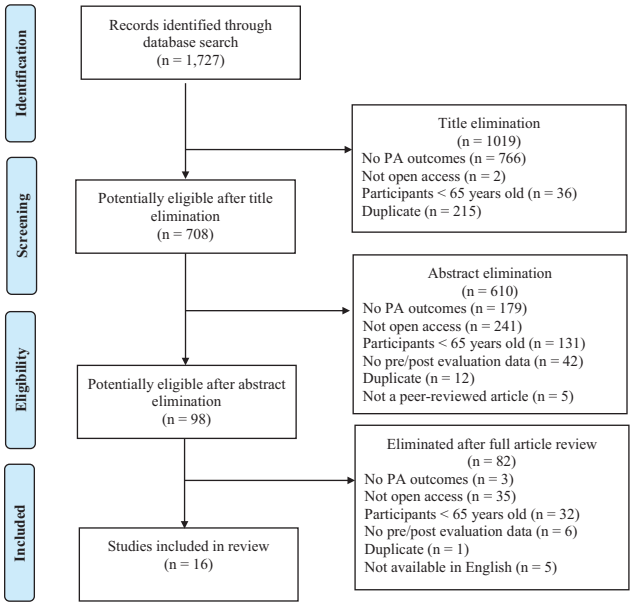

Figure 1. Eligibility and inclusion of peer-reviewed literature for open-access, community-based older adult physical activity programs.

The initial search of grey literature sources yielded 55 programs. The full text of these program websites, impact statements, or *JOE* articles was assessed by the first author and 28 were excluded because they did not have a physical activity outcome (e.g., a nutrition or aging program that mentioned physical activity but did not target it) (n = 17), did not target older adults (n = 4), or were duplicates (n = 7). Grey literature sources without pre and post evaluation data or number of participants were included until the program contact person could be emailed to request this information. This left 27 sources which potentially met inclusion criteria for the review. After contacting program personnel for additional program data, 10 sources were excluded because they did not provide pre and post evaluation data or number of participants (n = 9) (see Appendix B for a list of these programs) or it was determined that there was no physical activity outcome (n = 1). This left 17 grey literature sources that met inclusion criteria for the review. (See Figure 2.)

Data Extraction and Synthesis

A data extraction tool was developed based on Estabrooks, Harden, and Burke's (2012) systematic review on group dynamics and focusing on a balanced understanding of internal and external validity of the program. The extraction tool included characteristics of the study design, intervention, delivery personnel, and sample, as well as research design and analysis features. Program characteristics include the use of behavioral theories or models, individual and group strategies, intervention functions (Michie et al., 2011), the frequency and duration of the program, and the type of physical activity. As for delivery personnel, expertise, training, and personal characteristics

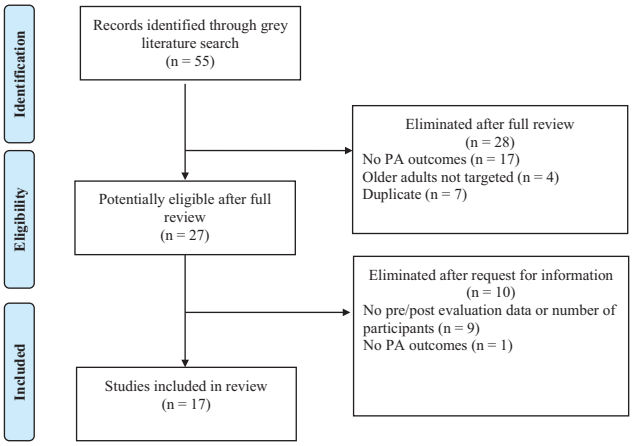

Figure 2. Eligibility and inclusion of grey literature for older adult physical activity Extension programs.

were explored. Sample characteristics included sex, age, body mass index, race, ethnicity, education level, and income.

The first and senior author coded two articles, then met to discuss and resolve discrepancies. Agreement between authors was 95%. Coding guide definitions were then refined based on items that were deemed unclear. The first four authors then coded three articles to determine inter-rater reliability; agreement between authors was 81%. The remaining studies were each independently coded by two authors. After the adjustments to the coding guide, agreement between authors was 88% across the 109 variables and 11 remaining studies.

Four items were most often discrepant between coders. Discrepancies were related to "contacts delivered face-to-face" because some manuscripts did not report how frequently and how long face-to- face program components were. "Other exercise delivery agent" was also often discrepant. This was due to determining if various delivery agents (such as "researchers and staff," "physical trainers," "trained instructors," and "physical therapists") should be included in the existing categories or considered "other." See Appendix C for options from the coding guide. Discrepancies also existed with "physical activity measure type," as there were differences between coders in determining which measures should be considered primary outcome measures. For example, if a study had functional fitness and self-report physical activity, discrepancies were resolved based on the definition used by the manuscript authors. Finally, "calculated attrition" was also often discrepant. Several articles did not clearly report sample sizes for both baseline and analysis, making it difficult to calculate attrition rates. Any discrepancies between coders were discussed and resolved to determine the final data used; discrepancies were resolved by consulting with the senior author. The grey literature sources were coded by the first author and verified by the senior author; this procedure was used due to the much smaller amount of information to be extracted.

Results

Sixteen interventions from the peer-reviewed literature were analyzed (see Table 1). All of the interventions are considered "programs," as they include direct education. Four of the programs (25%) were conducted in the United States, whereas the remaining programs were conducted in Japan (31%), Taiwan (19%), Chile (6%), England (6%), Finland (6%), and Korea (6%). Programs ranged in duration from a one-time session to two years, with the average program lasting 25 weeks (±32) with a total of 64 (±86) face-to-face contact hours. Five of the programs included additional contact types: brochures (n = 3 programs, 19%), multimedia (n = 1 program, 6%), and phone calls (n = 1 program, 6%). The most common physical activity components were strength training (n = 15 programs, 94%), flexibility (n = 13 programs, 81%), and balance (n = 12 programs, 75%), while 14 of the programs (88%) included a combination of two or three of these components.

Six of the programs (38%) included individual behavioral strategies, whereas none of the programs included specific group-based strategies. Three of the programs (19%) were based on a behavioral theory or model: Social Ecological Model (n = 1 program, 6%), Social Cognitive Theory (n = 1 program, 6%), and Cognitive Evaluation (n = 1 program, 6%). As for delivery personnel, 14 manuscripts (88%) reported delivery agent type. The most common were exercise professionals (n = 8 programs, 50%) and physical therapists (n = 4 programs; 25%). None of the programs used lay or community-based educators. Two of the programs (13%) described the training strategy for the delivery personnel: "12 hours of training related to special issues in older adults and EF [EnhanceFitness] procedures and protocols" (Belza et al., 2006) and a "training course to be familiar with the protocol and all the educational contents" (Hsu, Wang, Chen, Chang, & Wang, 2010). Eleven of the programs (69%) reported positive outcomes, including increases in strength, balance, and functional mobility, and reductions in falls. The remaining reported no changes (n = 4; 25%) or negative impact (n = 1; 6%) on exercise outcomes.

Results for the grey literature identified 17 interventions in 15 states. These interventions also include direct education and are all considered "programs." Four of the programs (24%) were based on a behavioral theory or model: Transtheoretical Model (n = 2 programs, 12%), Health Belief Model (n = 1 program, 6%), and Social Cognitive Theory (n = 1 program, 6%). Programs ranged in duration from a one-time session to one year, with the average program lasting 14 weeks (±14). Five programs (29%) reported total face-to-face contact hours; the average of these was 18 hours (±21). Five of the programs (29%) included one or more additional contact types: newsletters (n = 2 programs, 12%), handouts (n = 2 programs, 12%), internet (n = 1 program, 6%), and phone calls (n = 1 program, 6%). The most common physical activity components were strength training (n = 10 programs, 59%),

Table 1. Older Adult Physical Activity Program Variables from Peer-Reviewed and Grey Literature

	Peer-reviewed literature			Grey literature	
Variable	Positive effects (*n* = 11)	Null results (*n* = 4)	Negative outcomes (*n* = 1)	Positive effects (*n* = 17)	Total (*n* = 33)
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Duration	28 weeks (±39)	25 weeks (±19)	1 week	14 weeks (±14)	21 weeks (±25)
Face-to-face contact hours	55 hours (±51)	96 hours (±144)	3 hours	18 hours (±21)	49 hours (±75)
	N (%)	*N (%)*	*N (%)*	*N (%)*	*N (%)*
Behavioral theory/model					
Social cognitive theory	0 (0)	1 (25)	0 (0)	1 (6)	2 (6)
Transtheoretical model	0 (0)	0 (0)	0 (0)	2 (12)	2 (6)
Health belief model	0 (0)	0 (0)	0 (0)	1 (6)	1 (3)
Social ecological model	1 (9)	0 (0)	0 (0)	0 (0)	1 (3)
Other theory	2 (18)	1 (25)	0 (0)	1 (9)	3 (9)
Combination	2 (18)	1 (25)	0 (0)	2 (12)	5 (15)
No theory	9 (82)	3 (75)	1 (100)	13 (76)	26 (79)
Physical activity components					
Strength	10 (91)	4 (100)	1 (100)	10 (59)	25 (76)
Balance	9 (82)	2 (50)	1 (100)	4 (24)	16 (48)
Flexibility	8 (73)	4 (100)	1 (100)	3 (18)	16 (48)
Walking	3 (27)	2 (50)	0 (0)	0 (0)	5 (15)
General aerobic	2 (18)	1 (25)	0 (0)	1 (6)	3 (9)
Mind-body	1 (9)	1 (25)	0 (0)	0 (0)	2 (6)
Other	1 (9)	0 (0)	1 (100)	4 (24)	6 (18)
Combination	11 (100)	0 (0)	1 (100)	5 (29)	21 (64)
Other contact types					
Brochure	0 (0)	2 (50)	1 (100)	0 (0)	3 (9)
Newsletters	0 (0)	0 (0)	0 (0)	2 (12)	2 (6)
Handouts	0 (0)	0 (0)	0 (0)	2 (12)	2 (6)
Phone calls	0 (0)	0 (0)	1 (100)	1 (6)	2 (6)
Posters	0 (0)	1 (25)	0 (0)	1 (6)	2 (6)
Video	1 (9)	0 (0)	0 (0)	0 (0)	1 (3)
Multimedia	1 (9)	0 (0)	0 (0)	0 (0)	1 (3)
Internet	0 (0)	0 (0)	0 (0)	1 (6)	1 (3)
Other	1 (9)	0 (0)	0 (0)	2 (12)	3 (9)
Combination	1 (9)	1 (25)	1 (100)	2 (6)	5 (15)
No additional contact types	9 (82)	2 (50)	0 (0)	12 (71)	23 (70)
Behavioral strategies					
Individual	3 (27)	2 (50)	1 (100)	2 (12)	8 (24)
Group-based	0 (0)	0 (0)	0 (0)	1 (6)	1 (3)
No behavioral strategies	8 (73)	2 (50)	0 (0)	15 (88)	25 (76)
Delivery personnel					
Exercise professionals	6 (55)	2 (50)	0 (0)	0 (0)	8 (24)
Physical therapists	3 (27)	0 (0)	1 (100)	0 (0)	4 (12)
Extension educators/agents	0 (0)	0 (0)	0 (0)	4 (24)	4 (12)
Lay/para health educators	0 (0)	0 (0)	0 (0)	3 (18)	3 (9)
Community leaders	0 (0)	0 (0)	0 (0)	3 (18)	3 (9)
Other	2 (18)	3 (75)	1 (100)	6 (35)	7 (21)
Multiple types	1 (9)	1 (25)	1 (100)	4 (24)	7 (21)

balance (*n* = 4 programs, 24%), and flexibility (*n* = 3 programs, 18%) while four of the programs (24%) included a combination of two or three of these components.

Two of the programs (12%) included individual behavioral strategies, whereas one program (6%) included group-based strategies. As for delivery personnel, eight sources (47%) reported delivery agent type. The most common were Extension educators/agents (*n* = 4 programs, 24%), lay/para health educators (*n* = 3 programs, 18%), and community leaders (*n* = 3 programs, 18%). Six of the

programs (35%) described the training strategy for the delivery personnel: "Trained through 10 day-long workshops. An "agent trainer" structure was developed, with 16 county FCS agents selected to serve as trainers across the state" (L. Washburn, personal communication, February 28, 2017), "Completed five online modules at home and attended a 4- hr workshop" (Sowle et al., 2016), "The peer advocate trainer goes through a 1-day train-the-trainers workshop on how to implement Project Healthy Bones"(Klotzbach-Shimomura, 2001), "Master Trainers… facilitate at least one class leader training each year" (J. Strommen, personal communication, February 6, 2017), "Extension agents offered local training workshops and prepared… community leaders to teach Taking Charge workshops" (E. Bowen, personal communication, February 9, 2017), and "Strong Women™ Ambassador…. conducted training sessions" (A. Flickinger, personal communication, February 15, 2017). All of the programs reported positive outcomes, including increases in strength, flexibility, and balance, and decreases in fall risk.

Independent-samples *t*-tests were conducted to compare program duration and face-to-face contact hours in peer-reviewed literature and grey literature programs. There was no significant difference in program duration in effective peer-reviewed (M = 28 weeks, standard deviation [SD] = 39) and grey literature (mean [M] = 14 weeks, SD = 14) programs; p = .136. There was also no significant difference in face-to-face contact hours in effective peer-reviewed (M = 51, SD = 51) and grey literature (M = 18, SD = 21) programs; p = .059.

Discussion and Implications

The purpose of this review was to explore key characteristics of open-access, community-based physical activity programs for older adults. As a summary, the older adult physical activity programs included outcomes of increasing strength, improving balance, decreasing falls/risk of falls, or increasing physical activity levels; were *not* based on behavioral theories and do *not* include behavioral strategies; were conducted over an average of 20 weeks with 40 face-to-face contact hours; included strength training; did *not* include additional contact types (e.g., brochures or multimedia); and were delivered by a variety of personnel (exercise professionals, Extension educators, physical therapists, lay/para health educators, and community leaders). Overall, the results indicate several differences and similarities between effective older adult physical activity programs in peer-reviewed literature and Extension programs identified in the grey literature. The results also lead to recommendations for Extension programs to more effectively use evidence-based characteristics in their programming and to more effectively report their findings. In addition, as no previous systematic reviews of community-based, open-access programs exist, the effective characteristics will be compared to those found in existing reviews of older adult physical activity programs.

Extension programs and peer-reviewed literature programs differed in their duration, face-to-face contact hours, physical activity components, and delivery personnel. Extension programs were shorter duration with fewer face-to-face contact hours than peer-reviewed literature programs. Although the difference was not significant, it is expected that the difference may have been significant with a larger sample. The results suggest that both types of programs can vary widely in their duration and face-to-face contact hours. Previous systematic reviews, while not specific to open-access, community-based interventions, found program duration varied widely (Conn et al., 2003; King et al., 1998; Moore et al., 2016) and that there was no relationship between duration or contact hours and program effectiveness (Chase, 2015; Hobbs et al., 2013). This suggests that further research is needed on the minimum program duration required to achieve physical activity outcomes.

Extension programs were also less likely to use a combination of physical activity components (e.g., strength, balance, and flexibility). Previous systematic reviews suggest that multicomponent physical activity programs are more effective for preventing falls (Baker et al., 2007) and maintaining activities of daily living in frail older adults (de Labra et al., 2015). King and colleagues (1998) found that many of the effective programs in their systematic review (of older adults aged 50 and over) included combinations of physical activity components; however, they were not combined is a systematic way, and it is difficult to determine the optimal combination of components.

Programs reported in peer-reviewed literature were more likely to use trained professionals such as exercise professionals and physical therapists, whereas Extension programs were more likely to use Extension educators/agents, lay/para health educators, and community leaders. However, the systematic reviews by Chase (2015) and Conn and colleagues (2003) found that effective programs are delivered by a variety of personnel, including both trained professionals (certified exercise trainers and health care providers) and those without professional training (community lay people and graduate students), demonstrating that a variety of delivery agents are capable of delivering interventions.

Extension programs were similar to peer-reviewed literature programs in their limited use of additional contact methods (brochures, newsletters, phone calls, etc.). One previous systematic review found that programs that included mailed materials (newsletters or tracking calendars) or audio-visual materials (CDs or videos of exercise instruction) were more effective than those that did not (Chase, 2015). In addition, King and colleagues (1998) found that programs using ongoing telephone supervision of physical activity in place of face-to-face instruction were just as effective with similar or better adherence

rates. More research into additional contact methods and delivery modes would be useful before recommending that Extension educators/agents supplement in-person delivery with these methods.

Peer-reviewed literature and grey literature programs were also similar in their limited use of behavioral theories and group-based strategies. Three previous systematic reviews found that most effective programs are theory-based (Baxter et al., 2016; Chase, 2015; Conn et al., 2003), whereas one additional review did not mention behavioral theories, but did find that effective programs are based on behavioral or cognitive-behavioral strategies, such as goal setting and self-monitoring (King et al., 1998). Interestingly, only one program, Extension's Matter of Balance, reported using a group-based strategy (Young, 2016). The program used "practical problem solving through group discussion" (Young, 2016). Group-based strategies, such as group goal setting and group problem solving, have been shown to be an effective method of promoting physical activity (Harden et al., 2015).

The overall results present an opportunity for Extension to more effectively use evidence-based strategies in their older adult physical activity programs. The average duration of an effective program (20 weeks, 40 total contact hours) may not be feasible for Extension educators or their community partners due to other programming demands, as educators typically offer multiple programs in several subject areas. An alternative option is to implement programs that are shorter in duration but, as recommended in health promotion literature, are based on behavioral theories (Glanz, Rimer, & Lewis, 2002; Horodyska et al., 2015) and include group dynamics (Burke, Carron, Eys, Ntoumanis, & Estabrooks, 2006; Estabrooks et al., 2012; Harden et al., 2015). Including these components could promote long-term behavior change after completion of the program (Burke et al., 2006; Estabrooks et al., 2012; Glanz et al., 2002). Interventions should be based on a behavioral theory to explain specifically how behavior change will occur (Glanz et al., 2002). Group-based strategies have been shown to be more effective than individual behavioral strategies for older adults (Burke et al., 2006), as they tend to be socially isolated (Wilcox, Castro, King, Housemann, & Brownson, 2000) and are motivated by the social interaction provided by group-based programs (Burke et al., 2006).

Using trained exercise professionals is not always feasible or sustainable for Extension. However, those delivering physical activity programs may not need to have exercise-specific certifications. Extension educators also deliver nutrition interventions without necessarily having nutrition credentials (e.g., Registered Dietitian), since they are often generalists. An alternative to using trained professionals is to provide training for Extension educators in core physical activity competencies prior to delivering physical activity programs. After receiving training, Extension educators can also train lay/para health educators and community leaders to implement their physical activity programs through train-the-trainer methods, as was described in five of the grey literature sources (E. Bowen, personal communication, February 9, 2017; A. Flickinger, personal communication, February 15, 2017; Klotzbach-Shimomura, 2001; J. Strommen, personal communication, February 6, 2017; L. Washburn, personal communication, February 28, 2017). Using Extension educators, lay/para health educators, and community leaders rather than trained exercise professionals to deliver physical activity programs will improve program uptake and sustainability.

Finally, it is also recommended that Extension programs include a combination of physical activity components (strength, balance, and flexibility) in order to facilitate positive outcomes in increased strength, improved balance, and decreased fall risk.

Limitations

It is worth noting that all of the Extension programs reported positive effects, compared to only 69% of the peer-reviewed literature programs. This made it difficult to make comparisons between peer-reviewed and Extension programs. This discrepancy in reporting may be due to the less stringent manner in which Extension programs were tested and how outcomes are reported. Seven of the Extension programs (41%) used a pre–post design, whereas the remaining programs (59%) either only used a post-test or only reported the number of participants. In comparison, nine of the peer-reviewed literature programs (56%) used a randomized controlled trial design, two (13%) used a quasi-experimental with control design, and five (31%) used a pre–post design.

In addition, six of the Extension programs (35%) reported physical activity outcomes through a peer-reviewed source, *Journal of Extension*, although it is nonindexed with no impact factor, while the remaining programs results (65%) were reported through sources that are not peer-reviewed (websites and/or impact statements). This presents an opportunity for Extension programs to more effectively report their findings through peer-reviewed sources so that effective programs can be disseminated to reach a broader population. It is also recognized that the results of older adult strength training programs delivered through Extension have been published in peer-reviewed sources that were not captured in our review. For example, studies have been published on the Extension–delivered Strong Women (Washburn, Cornell, Phillips, Felix, & Traywick, 2014) and Stay Strong, Stay Healthy (Ball et al., 2013, Crowe & Ball, 2015) programs. These were likely not captured in our peer-reviewed literature search as the specific combinations of search terms and age restriction (aged 65 and older) were not used. In addition, as with other systematic reviews, some publications may have been missed due to not being PubMed indexed.

Conclusion

Open-access, community-based programs are a recommended method for older adults to increase physical activity levels. The results of the review indicate notable differences between peer-reviewed literature and Extension programs and present an opportunity for Extension programs to more effectively use evidence-based program characteristics, including behavioral theories and group dynamics, a combination of physical activity components, and educator/agent-trained delivery agents. The results also indicate a need for Extension programs to more effectively report their findings through peer-reviewed sources so that effective programs can be disseminated to reach a broader population. Taken together, strategic dissemination and implementation of evidence-based programs may be improved both within and outside of the Cooperative Extension System. These efforts will ensure that Extension programming is evidence-based and that exercise and behavioral scientists inform Extension professionals of their research-generated advancements in physical activity promotion. Future research can investigate a dissemination network that can be used to aid the spread of effective programs through the Extension system.

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Conflict of Interest

None reported.

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