



Effectiveness of statewide falls prevention efforts with and without group exercise



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ABSTRACT

Group-based falls prevention programs vary in use of exercise, education, home modification, and other program elements. Pennsylvania's Department of Aging offers two large-scale falls prevention programs that differ in these components, allowing a strong test of the effectiveness of exercise in reducing falls incidence relative to less intensive education-based programs. In 2016–2017, we followed three groups of older adults attending senior centers: (i) older adults who completed *Healthy Steps in Motion* (HSIM, $n = 560$), an 8-week exercise program, (ii) older adults completing *Healthy Steps for Older Adults* (HSOA, $n = 651$), a falls education workshop with assessment and referral; and (iii) older adults not completing falls prevention programs ($n = 787$). Participants were followed for up to 6 months with monthly ascertainment of falls. We estimated Poisson regression models to compare incidence rate ratios. The groups did not differ in falls risk at baseline or attrition over follow-up. HSIM participants reported 5.3 fall months per 100 person-months of follow-up. The group not completing falls prevention programming reported 7.3 (incidence rate ratio [IRR], 0.72 [0.59, 0.89]), and the group completing HSOA 6.5 (IRR, 0.82 [0.66, 1.02]). In stratified analyses, falls incidence was lower in HSIM for older adults reporting better balance and no falls in the prior 12 months. Non-exercise-based falls prevention programs may also reduce falls, perhaps through indirect physical benefits such as greater social engagement and increased activity.

1. Introduction

Falls are the leading cause of injury-related deaths of older adults and the primary reason for older adult emergency department visits and hospital admissions for trauma (NCOA, 2012). In 2014, the rate of non-fatal injuries requiring emergency department care was 2297 per 100,000 among people aged 50–54 but 15,060 among people aged 85 or older (WISQARS, 2017). Among adults aged 65+, falls incidence has increased between 1998 and 2010, with falls increasing most in people less than age 85 (Cigolle et al., 2015). Self-report measures from ongoing health surveys continue to confirm high risk of falls (25–30% in people aged 65 or older) and increases with age (40–50% of adults aged 80+) (Gillespie et al., 2009; Fleming et al., 2008). Non-injurious falls are also disabling in that they are associated with activity restriction, isolation, deconditioning, and depression (King, 2009; Tinetti, 2003; Morley, 2002). In 2010, costs associated with falls in the U.S. totaled about \$14.1 billion (including death, hospital care, emergency department admissions, and loss of work days) (WISQARS, 2017), and a more recent analysis suggests annual costs of \$31 billion with adjustment for inflation (Burns et al., 2016).

Risk factors for falls include sedative use, poor vision, cognitive impairment, lower extremity weakness, poor reflexes, abnormalities of balance and gait, pain, foot problems, and environmental hazards (Tinetti et al., 1994; Tinetti and Williams, 1998). These risk factors have been addressed with clinical interventions that have been adapted for community-level efforts. A review of five prospective but non-randomized community trials with matched control communities suggested that falls-related fractures could be reduced by 6–33% (McClure et al., 2005), and meta-analyses and systematic reviews provide support for the effectiveness of multifactorial falls risk assessments and management (Gates et al., 2008).

Results from randomized controlled trials have been more equivocal. In one recent trial, the Lifestyle Interventions and Independence for Elders (LIFE) study, respondents at risk for mobility disability were randomized to a physical activity intervention, which lasted 24–42 months, or to health education. The physical activity intervention consisted of walking (goal, 150 min/week) and strength, flexibility, and balance training delivered in two group sessions a week and home-based activity 3–4 times a week. The incidence of serious falls injury did not differ over 2.6 years between participants in the physical

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activity group (9.2%) and in the health education control (10.3%), though subgroup analyses demonstrated benefit for men in risk of serious falls injuries, fall-related fractures, and fall-related hospital admissions (Gill et al., 2016).

Recommendations for optimal falls prevention are still evolving (Moyer and U.S. Preventive Services Task Force, 2012; AGS/BGS, 2010). However, a 2012 updated Cochrane Review reported that “group and home-based exercise programmes, usually containing some balance and strength training exercises, effectively reduced falls” (Gillespie et al., 2012). CDC has compiled a compendium of successful interventions for public health practitioners and community-based organizations (Stevens and Sogolo, 2010; National Center for Injury Prevention and Control, 2008).

The Pennsylvania Department of Aging has opted for a primary prevention approach to falls. Older adults are screened at senior centers and related venues for falls risk and invited to participate in falls prevention programs. One program, *Healthy Steps for Older Adults*, involving falls risk assessment, referral for clinical and home safety services, and education, has been shown to be effective in reducing falls incidence (Albert et al., 2014a). A second program is *Healthy Steps in Motion* (HSIM), a group exercise program for people of all fitness levels who attend 1-h sessions offered twice a week for eight weeks. Information about the program is available at the Pennsylvania Department of Aging website (<http://www.aging.pa.gov/aging-services/health-wellness/Pages/Healthy-Steps-in-Motion.aspx>). The programs are offered at the discretion of local Area Agencies on Aging (AAAs), who contract with the PA Department of Aging, according to available staff and volunteers. Sites participating in this research included HSOA and non-falls prevention programs in 2010–13 and HSIM in 2015–16. We assessed the reduction in falls risk associated with HSIM, an exercise-based program, relative to a less intensive falls prevention education workshop, HSOA, offered in the same settings. We assessed the effectiveness of both programs relative to a non-program comparison group.

2. Methods

In 2016–2017, we enrolled 560 older adults who completed *Healthy Steps in Motion* (HSIM). Participants were recruited on site or shortly after completing the program through telephone contact. We compared falls incidence of HSIM participants to (i) people completing the less intensive education-based *Healthy Steps for Older Adults*, HSOA, ($n = 651$) and (ii) a group not completing falls prevention ($n = 787$). All participants were recruited from the same senior center settings and followed monthly for up to 6 months. The comparison groups were followed in an earlier study (2011–2014), and details regarding recruitment and falls incidence have been reported (Albert et al., 2014a; Albert et al., 2014b). The University of Pittsburgh Institutional Review Board reviewed the research protocol, and all participants signed informed consent.

All three groups completed an in-person telephone baseline interview after providing informed consent. In this analysis, we limit comparison of falls incidence to the first 6 months after program participation because the HSIM group was followed for a maximum of 6 months. We also limit the comparison groups to people completing monthly follow up by interactive voice response (IVR) telephone calls. This restriction allows a more conservative approach, since people in the comparison groups receiving personal calls were older and more impaired (Albert et al., 2014b).

2.1. Intervention

The Pennsylvania Department of Aging has offered *Healthy Steps in Motion* (HSIM) on a statewide basis through its senior centers since 2007. HSIM involves (i) instructor-led classes that offer strength and balance exercises delivered in community venues; (ii) training of

instructors by certified exercise physiologists; (iii) dissemination in a state-reimbursed program at senior centers, churches, subsidized housing facilities, nursing homes, assisted living centers, and YMCAs across Pennsylvania; and (iv) integration with Pennsylvania Department of Aging's data collection and program metrics. One-hour exercise classes are offered twice a week for 8 weeks.

The exercise program itself stresses education and exercise. Participants receive instruction on proper technique, which is followed by guided group exercise. The focus is on learning new exercises, building lower extremity strength, improving flexibility, improving balance, setting and tracking goals, and socialization. An important feature is a focus on function, linking exercises to valued activities. For example, participants learn that specific exercises (e.g., stationary lunge, sit to squat, and squat with adduction) help with daily functional challenges (e.g., stepping up on a curb). HSIM is also linked to ongoing classes involving aerobic walking.

The program includes an extensive manual for training workshop leaders, with instruction by an exercise physiologist, guidance for instructors who wish to collaborate with clinical partners (e.g., physical therapists, hospitals), tailoring of exercises to falls risk using performance-based assessments at the start of the class (Get Up and Go, One Leg Stand, Chair to Stand), and a standard physical skills screening to identify participants who should not exercise until they obtain physician clearance. Access to weights and bands for some exercises is preferred but not required. Online modules and videos are available for workshop leaders to enhance or review HSIM training.

The Health & Wellness office of the Pennsylvania Department of Aging assures program fidelity by training staff at sites (over 350 sites yearly), monitoring data entry, and conducting monthly conference calls with Pennsylvania's 52 county Area Agencies on Aging. A Participant Guide is also available in Spanish.

2.2. Comparison groups

Healthy Steps for Older Adults (HSOA) is a less intensive evidence-based falls prevention program. It includes the same physical performance assessments of falls risk; referrals for physician care and home safety for participants scoring below age- and gender-based norms on performance assessments; and a 2-hour falls prevention class involving recognition of home hazards and falls risk situations. It does not involve group exercise, though its manual includes a guide to exercise. From prior research, 651 older adults completing HSOA had follow-up assessments by IVR and were available for analysis.

People not completing HSIM or HSOA but attending the same Pennsylvania Department of Aging senior venues were also recruited. These older adults were attending senior sites for other programs, such as subsidized lunches, discussion groups, food bank distributions, organized trips, bingo, and related activities. They agreed to join the study after research staff made presentations. The group not participating in the falls prevention programs consisted of 787 with follow-up IVR data.

All participants who had signed up for HSIM or HSOA and who signed consent for follow-up were included in analyses, regardless of how many sessions they completed or level of motivation. No participants in any study arm received compensation.

2.3. Outcomes

The primary outcome was falls incidence over 6 months, which we measured as months in which participants reported a fall (fall-months) per 100 person-months of follow-up. To calculate incidence density, we summed the number of months in which respondents reported a fall (fall-months) and divided this number by total follow-up months.

Falls were elicited in a monthly telephone call an interactive voice response (IVR) system (Albert et al., 2015). We tracked all falls, not just injurious falls. Participants who signed consent were registered in a

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