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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

web-based system that generated the monthly telephone calls. Every 30 days, participants were called twice a day for up to 8 days and completed the brief automated call to elicit falls, weekly activity, hospitalization, and emergency department use. We chose twice a day for up to 8 days to maximize response but keep burden down. A final question asked if participants would like a telephone call from the research team. Respondents answered questions by pushing buttons on the telephone. For falls, respondents were asked, "Think about the last 30 days. Did you fall in the last 30 days, that is, end up on the floor or ground because you were unable to stop yourself? Press 1 for yes, 2 for no." The monthly calls took a mean of 2.5 min to complete. Participants could opt out of the automated IVR system at any point over follow-up. Given the geographic dispersion of the sample across Pennsylvania counties, all measures were obtained by telephone.

2.4. Measures

In addition to self-reported falls and activity over follow-up, we collected measures at baseline to assess comparability of the groups. These included demographic measures (age, gender, education) and falls risk factors (self-rated balance and falls in prior 12 months).

2.5. Reliability and validity of self-reported falls

Evidence for the reliability and validity of falls reported in the monthly telephone follow-up is reported in our prior assessment of HSOA (Albert et al., 2014a; Albert et al., 2014b). For reliability, we found that people who had completed an automated IVR assessment and a personal telephone call regarding falls agreed in 95.3% of cases.

We assessed validity in two ways. First, we examined baseline reports of balance and reported falls over follow-up. People reporting excellent, very good, or good balance reported a mean of 5 fall-months per 100 months of follow-up, while the risk of falls among people reporting fair-poor balance was more than twice as high (incidence rate ratio, IRR [95% CI] for excellent, very good, good vs. fair-poor, 0.62 [0.53, 0.73]). This difference suggests that self-reported falls is associated with a well-recognized falls risk factor (Albert et al., 2014a). In the HSIM sample, self-reports of fair-poor balance were significantly related to reports of falls, hospitalization, and emergency department use over the follow-up period (results available upon request).

Second, we examined self-reported falls relative to performance-based assessment of lower extremity strength at baseline (Chair to stand assessments conducted at sites). People in the highest risk tertile reported 7.2 fall-months per 100 compared to 5.2 in people in the lowest risk tertile (IRR [95% CI], 1.39 [1.0, 1.98]) (Albert et al., 2015). These analyses suggest that self-reports of falls elicited in our protocol are a reliable and valid indicator.

2.6. Analyses

Descriptive statistics were calculated for the three groups. Incidence rate ratios (IRR) and 95% confidence intervals were estimated using Poisson regression models for the programs as a whole and also within defined demographic and falls risk status groups. Analyses were conducted using SPSS and Stata. As reported in earlier assessments of HSOA, power was adequate for detecting 13–14% reductions in falls risk (Albert et al., 2014a). Results are reported as incidence rate ratios for number of fall months per 100 person-months of follow up.

3. Results

Participants in the three groups were drawn from senior centers in 24 Pennsylvania counties. HSIM, HSOA, and non-falls prevention program sites overlapped in 13 counties; and all three arms included a quarter of respondents in rural counties, defined as counties with < 250,000 residents. Urban-rural site location was not associated with differences in falls incidence.

Table 1
Healthy Steps in Motion (HSIM), Healthy Steps for Older Adults (HSOA), and no falls prevention comparison group: features at baseline.

	HSIM (n = 556)	HSOA (n = 651)	Non-program comparison (n = 787)
Age 75 +, %	50.7	53.4	51.8
Female, %	89.2	85.4	75.7
Any college education, %	25.4	42.2	39.7
Report fall in prior 12 mo, %	25.6	31.0	26.7
Self-reported fair–poor balance, %	32.6	26.1	23.4

Attrition in the HSIM cohort over 6 months was low at 7.5% and not significantly different from the experience of the non-program comparison (5.8%) and HSOA (5.7%) cohorts. Of 560 enrolled in HSIM, 556 provided at least one follow-up assessment.

3.1. Comparability of study groups

At baseline, HSIM participants were age (sd) 75.3 (8.5). Women were 89.2% of participants, 25.4% had at least some college education, 25.6% reported a fall in the prior 12 months, and 32.6% reported fair or poor balance. As shown in Table 1, the three groups were on the whole similar. Relative to the other groups, HSIM participants were more likely to include women (89.2% vs. 75.7% and 85.4%) but less likely to have post-secondary schooling (25.4% vs. 39.7% and 42.1%). While not statistically significant, the prevalence of self-reported fair-poor balance at baseline varied across the groups, with HSIM participants most likely to report fair-poor balance (32.6% vs. 23.4% and 26.1%). Reports of falls in the prior 12 months before the start of follow up also varied, from 25.6% to 31.0%. As a result, we stratified analyses by self-reported balance and history of falls in addition to demographic characteristics.

3.2. Falls incidence

Differences in falls outcomes between the groups, overall and stratified by demographic and falls risk status, are shown in Table 2. Over comparable periods of follow-up, HSIM participants had 5.3 falls per 100 person-months of follow-up. The non-program comparison cohort had 7.3 falls, so that the reduction in falls associated with HSIM was 28% (incidence rate ratio [IRR] 0.72, 95% confidence interval [CI]: 0.59, 0.89). The HSOA cohort had 6.5 falls, with an 18% reduction in falls associated with HSOA (IRR 0.82, 95% CI: 0.66, 1.02), which was borderline in significance. Falls incidence in the HSOA cohort was lower than in the non-program comparison group but did not achieve statistical significance (6.5 vs. 7.3 fall-months per 100 months, IRR [95% CI] 0.88 [0.73, 1.07]).

Among sociodemographic factors, HSIM was associated with about a third lower risk of fall months among people aged 75 + (5.0 vs. 7.5 in HSOA [IRR 0.66, 95% CI: 0.49, 0.90] and 8.1 in the non-program group [IRR 0.62, 95% CI: 0.46, 0.82]), but did not offer significant benefit for people under age 75. HSIM was effective in reducing falls risk among women but less so among men, and only relative to the non-program group (5.1 vs. 7.2 [IRR 0.71, 95% CI: 0.56, 0.89]). HSIM reduced falls risk relative to the non-program comparison in both education strata.

Stratifying by baseline self-reports of balance showed that HSIM reduced falls incidence in the group reporting good, very good, or excellent balance relative to the non-program control (3.8 vs. 5.3 falls, IRR, 0.71 [0.53, 0.95]) and less intensive HSOA program (3.8 vs. 5.3, IRR, 0.72 [0.53, 0.97]). Among people reporting fair-poor balance, HSIM was superior only to the non-program control (8.8 vs. 14.3 falls, IRR = 0.61 [0.45, 0.82]).

Table 2
Falls incidence (fall-months per 100 months), 6-month follow-up: incidence rate ratio, IRR (95% confidence interval) for HSIM relative to comparison groups.

	Healthy Steps in Motion, HSIM	Compared to: *Healthy Steps for Older Adults*, HSOA	Compared to: Non-falls prevention participants
	Incidence	Incidence, IRR (95% CI)	Incidence, IRR (95% CI)
All participants	5.3	6.5, 0.82 (0.66, 1.02)	7.3, 0.72 (0.59, 0.89)
Age			
≤ 75	5.6	5.2, 1.07 (0.77, 1.51)	6.4, 0.87 (0.65, 1.17)
> 75	5.0	7.5, 0.66 (0.49, 0.90)	8.1, 0.62 (0.46, 0.82)
Gender			
Male	7.2	8.7, 0.82 (0.46, 1.42)	7.8, 0.92 (0.53, 1.51)
Female	5.1	6.1, 0.83 (0.65, 1.06)	7.2, 0.71 (0.56, 0.89)
College education			
None	5.2	6.6, 0.79 (0.60, 1.04)	7.0, 0.74 (0.58, 0.96)
Any	5.2	6.5, 0.81 (0.53, 1.19)	7.9, 0.66 (0.44, 0.96)
Self-reported balance			
Fair-poor	8.8	10.1, 0.87 (0.63, 1.20)	14.3, 0.61 (0.45, 0.82)
Good-very good-excellent	3.8	5.3, 0.72 (0.53, 0.97)	5.3, 0.71 (0.53, 0.95)
Reported fall, prior 12 mo			
Fall	12.9	10.3, 1.30 (0.93, 1.69)	13.1, 0.99 (0.75, 1.30)
No fall	2.7	4.8, 0.57 (0.40, 0.79)	5.2, 0.52 (0.38, 0.71)

We also assessed the effect of HSIM on falls incidence according to whether participants reported a fall in the 12 months prior to starting HSIM. Among people reporting a fall in the prior 12 months, falls incidence did not significantly differ between the three groups. Among people not reporting a fall, however, falls incidence was 2.7 in HSIM, 5.2 in the non-program group (IRR = 0.52 [0.38, 0.71]), and 4.8 in the HSOA group (IRR = 0.57 [0.40, 0.79]).

4. Discussion

In comparing two statewide falls prevention programs, an exercise-based program vs. education with assessment and referral, we saw an 18% reduction in falls incidence in the exercise program. Though this difference was not significant overall, in stratified analyses the exercise program was associated with a significant reduction in falls incidence for older adults reporting better balance at baseline and no falls in the prior 12 months. These findings suggest a number of important conclusions. First, for people with higher falls risk, more intensive prevention efforts may be required, such as physical therapy, personalized exercise, or multifactorial clinical interventions addressing vision, medications, assistance devices, and other factors, as recommended in the CDC STEADI protocol (Stevens, 2013). Second, non-exercise based programs, such as HSOA, may also offer indirect physical benefit, such as greater social engagement and increased activity. These indirect benefits, along with falls risk assessment, may also reduce falls, as we have shown elsewhere (Albert et al., 2014a). These findings suggest the value of a diverse approach to falls-prevention programming.

The effect of HSIM on falls risk was similar to results reported in meta-analyses of other group exercise programs, defined as classes including two or more categories of exercise. In the 2012 Cochrane systematic review mentioned earlier, exercise classes of this type "achieved a statistically significant reduction in rate of falls (pooled rate ratio (RaR) 0.71, 95% confidence interval (CI) 0.63 to 0.82; 3622 participants, 16 trials)" (Gillespie et al., 2012). This effect size is similar to the reduction in falls we observed with HSIM, as shown in Table 2. Our results differ from the Cochrane meta-analysis in that HSIM was not associated with falls reduction among participants who reported a fall in the prior 12 months. This difference in findings is worth further analysis. As mentioned earlier, more intensive falls prevention may be required for this group.

The benefits of HSIM and other group exercise programs are clear and will likely grow as a result of new efforts by the U.S. Administration for Community Living/Administration on Aging to promote evidence-based community programs for falls prevention (Kulinski et al., 2017). The benefit of programs such as HSIM will likely also have greater effect as these are combined with new efforts to prevent additional falls among people who have fallen and are followed in primary care (Phelan et al., 2017) or after hospitalization (Matchar et al., 2017) as well as interventions targeting specific falls risk populations, such as people receiving podiatry (Cockayne et al., 2017) and vision care (Keay et al., 2017). Finally, combining exercise programs with environmental interventions will likely offer benefit, as research continues to show strong associations between falls risk and the physical and social environment (Nicklett et al., 2017).

5. Conclusion and limitations

These findings should be interpreted in light of study limitations. First, the quasi-experimental approach cannot rule out unmeasured baseline differences between groups receiving and not receiving the interventions, and such differences may be responsible for benefit rather than the program itself. We sought to control for this bias by including participants from the same source population, people attending senior center programs. We also conducted stratified analyses for key sociodemographic and falls risk factors, such as self-rated balance and reports of a prior history of falls. Comparing two alternative falls prevention programs reduces biases that may be introduced by a participant's decision to attend a falls prevention program. However, people who make use of senior centers may be different from older adults as a whole. An important next step for this approach to falls prevention is to expand venues where the program is offered.

A second limitation is a lack of information on post-program falls prevention behavior. After completing falls prevention programs, participants in both HSIM and HSOA are encouraged to take advantage of related activities, such as walking clubs, Silver Sneakers, or Silver and Fit. It would be valuable to track such behavior change.

Finally, we examined all falls rather than injurious falls. While we obtained information on hospitalization and emergency department use, these were not specifically linked to reported falls in our comparison groups. Thus, we were unable to compare effects of HSIM on risk of injurious falls. However, reducing all falls is a valuable outcome in itself and offers advantages for statistical assessment.

Subject to these limitations, we conclude that large-scale statewide falls prevention programs, such as Pennsylvania's *Healthy Steps in Motion* (HSIM), are effective for falls prevention. HSIM was associated with lower falls incidence relative to a non-program comparison group. In a comparison with an education-based falls prevention program, HSIM was associated with fewer falls but mainly for older adults

reporting lower falls risk. These findings suggest the complexity of falls prevention programming: older adults at greater falls risk may require more intensive falls prevention programming, non-exercise programs may also offer indirect benefit through greater physical activity, and falls education may reduce falls risk if combined with medical referral and home safety efforts.

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Conflict of interest

The authors report no conflicts of interest. While the PA Department of Aging partly funded this research, the research and all analyses were conducted independently of the sponsor.

References

Albert, S.M., Edelstein, O., King, J., Lin, C.J., Boudreau, R., Newman, A.B., 2014a. Design of falls-free PA: a pragmatic clinical trial for primary prevention of falls among older adults in Pennsylvania. Prev. Sci. 31 (2), 141–148.

Albert, S.M., King, J., Boudreau, R., Prasad, T., Lin, C.J., Newman, A.B., 2014b. Primary prevention of falls: effectiveness of a statewide program. Am. J. Public Health 104 (5), e77–84. http://dx.doi.org/10.2105/AJPH.2013.301829.

Albert, S.M., King, J., Keene, R.M., 2015. Assessment of an interactive voice response system for identifying falls in a statewide sample of older adults. Prev. Med. 71C, 31–36. http://dx.doi.org/10.1016/j.ypmed.2014.12.006.

American Geriatrics Society, British Geriatrics Society, 2010. AGS/BGS Clinical Practice Guideline: Prevention of Falls in Older Persons. American Geriatrics Society, New York, pp. 2010. www.americangeriatrics.org/education/prevention_of_falls.shtml.

Burns, E.B., Stevens, J.A., Lee, R.L., 2016. The direct costs of fatal and non-fatal falls among older adults – United States. J. Saf. Res. 58, 99–103. http://dx.doi.org/10.1016/j.jsr.2016.05.001.

CDC WISQARS, 2017. http://www.cdc.gov/injury/wisqars/index.html (web archive link, 24 February 2017) (Accessed 24 February 2017).

Cigolle, C.T., Ha, J., Min, L.C., Lee, P.G., Gure, T.R., Alexander, N.B., Blaum, C.S., 2015. The epidemiologic data on falls, 1998–2010: more older Americans report falling. JAMA Intern. Med. 175 (3), 443–445. http://dx.doi.org/10.1001/jamainternmed.2014.7533.

Cockayne, S., Adamson, J., Clarke, A., Corbacho, B., Fairhurst, C., Green, L., Hewitt, C.E., Hicks, K., Kenan, A.M., Lamb, S.E., McIntosh, C., Menz, H.B., Redmond, A.C., Richardson, Z., Rodgers, S., Vernon, W., Watson, J., Torgerson, D.J., REFORM study, 2017. Cohort randomised controlled trial of a multifaceted podiatry intervention for the prevention of falls in older people (The REFORM Trial). PLoS One 12 (1), e0168712. http://dx.doi.org/10.1371/journal.pone.0168712.

Fleming, J., Brayne, C., The Cambridge City Over-75s Cohort (CC75C) Study Collaboration, 2008. Inability to get up after falling, subsequent time on floor, and summoning help: prospective cohort study in people over 90. BMJ 337, a2227.

Gates, S., Lamb, S.E., Fisher, J.D., Cooke, M.W., Carter, Y.H., 2008. Multifactorial assessment and targeted intervention for preventing falls and injuries among older people in community and emergency care settings: systematic review and meta-analysis. BMJ 336, 130–133. http://dx.doi.org/10.1136/bmj.39412.525243.BE.

Gill, T.M., Pahor, M., Guralnik, J.M., McDermott, M.M., King, A.C., Buford, T.W., Strotmeyer, E.S., Nelson, M.E., Sink, K.M., Demons, J.L., Kashaf, S.S., Walkup, M.P., Miller, M.E., LIFE Study Investigators, 2016. Effect of structured physical activity on prevention of serious fall injuries in adults aged 70–89: randomized clinical trial (LIFE Study). BMJ 352, i245. http://dx.doi.org/10.1136/bmj.i245.

Gillespie, L.D., Robertson, M.C., Gillespie, W.J., et al., 2009. Interventions for preventing falls in older people living in the community. Cochrane Database Syst. Rev. 2, CD007146. http://dx.doi.org/10.1002/14651858.CD007146.pub3.

Gillespie, L.D., Robertson, M.C., Gillespie, W.J., Sherrington, C., Gates, S., Clemson, L.M., Lamb, S.E., 2012 Sep. Interventions for preventing falls in older people living in the community. Cochrane Database Syst. Rev. 12, 9.

Keay, L., Dillon, L., Clemson, L., Tiedemann, A., Sherrington, C., McCluskey, P., Ramulu, P., Jan, S., Rogers, K., Martin, Tinsley, F., Jakobsen, K.B., Ivers, R.Q., 2017. Preventing falls in a high-risk, vision-impaired population through specialist orientation and mobility services: protocol for the platform randomised trial. Inj. Prev.. http://dx.doi.org/10.1136/injuryprev-2016-042301. (Feb 13. pii: injuryprev-2016-042301).

King, M.B., 2009. Falls. In: Halter, J.B. (Ed.), Hazzard's Geriatric Medicine and Gerontology. McGraw Hill, New York, pp. 659–670.

Kulinski, K., DiCocco, C., Skowronski, S., Sprowls, P., 2017. Advancing community-based falls prevention programs for older adults-the work of the administration for community living/administration on aging. Front. Public Health 5, 4. http://dx.doi.org/10.3389/fpubh.2017.00004.

Matchar, D.B., Duncan, P.W., Lien, C.T., Hock Ong, M.E., Lee, M., Gao, F., Sim, R., Eom, K., 2017. A randomized controlled trial of screening, risk modification and physical therapy to prevent falls among the elderly recently discharged from the emergency department to the community: the steps to avoid falls in the elderly study. Arch. Phys. Med. Rehabil. 17http://dx.doi.org/10.1016/j.apmr.2017.01.014. (30079-5).

McClure, R., Turner, C., Peel, N., et al., 2005. Population-based interventions for the prevention of fall-related injuries in older people. Cochrane Database Syst. Rev. 2, CD004441. http://dx.doi.org/10.1002/14651858.CD004441.pub2.

Morley, J.E., 2002. A fall is a major event in the life of an older person. J. Gerontol. A Biol. Sci. Med. Sci. 57, M492–M495.

Moyer, V.A., U.S. Preventive Services Task Force, 2012. Prevention of falls in community-dwelling older adults: U.S. Preventive Services Task Force recommendation statement. Ann. Intern. Med. 157 (3), 197–204.

National Center for Injury Prevention and Control, 2008. Preventing Falls: How to Develop Community-based Fall Prevention Programs for Older Adults. Centers for Disease Control and Prevention, Atlanta, GA.

NCOA, 2012. Standing Together to Prevent Falls. National Council on Aging.

Nicklett, E.J., Lohman, M.C., Smith, M.L., 2017. Neighborhood environment and falls among community-dwelling older adults. Int. J. Environ. Res. Public Health 14 (2). http://dx.doi.org/10.3390/ijerph14020175. (pii: E175).

Phelan, E.A., Pence, M., Williams, B., MacCornack, F.A., 2017. Telephone care management of fall risk: a feasibility study. Am. J. Prev. Med. 52 (3S3), S290–S294.

Stevens, J.A., 2013. The STEADI tool kit: a fall prevention resource for health care providers. IHS Prim. Care Provid. 39 (9), 162–166.

Stevens, J.A., Sogolo, E.D., 2010. Preventing Falls: What Works? A CDC Compendium of Effective Community-based Interventions From Around the World, 2nd edition. National Center for Injury Prevention and Control, Atlanta, GA.

Tinetti, M.E., 2003. Preventing falls in elderly persons. N. Engl. J. Med. 348, 42–49.

Tinetti, M.E., Williams, C.S., 1998. The effect of falls and fall injuries on functioning in community-dwelling older persons. J. Gerontol. A Biol. Sci. Med. Sci. 53, 112–119.

Tinetti, M.E., Baker, D.I., McAvay, G., et al., 1994. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. N. Engl. J. Med. 331, 821–827. http://dx.doi.org/10.1056/NEJM199409293311301.