

Table 2. Data Analysis

Author	Design	Setting	Sample Characteristics	Purpose and Intervention	Analysis Used	Finding
Arkkukangas et al. (2019)	Randomized Control Trial	Multicenter Sweden based general practices	Adults ages ≥ 75 years Sex 70%-female, 30% male Education level- 25% university, 18% HS, 14% secondary school and 43% elementary school Previous fall within a year- 58% no falls, 42% fall in the past year	Purpose: to investigate the effect of a home-based exercise program with or without motivational interviewing compared with standard care on fall frequency, physical performance, fall self-efficacy, balance, activity level, and handgrip strength Intervention: Home based exercise using the Otago exercise program (OEP), or OEP and motivational interviewing for 12 weeks delivered by a physical therapist	1-way analysis of variance power analysis was performed with PASS version 13.0.8. Baseline characteristics were measured with Kruskal-Wallis and Fisher exact tests, and the χ^2 test was used for categorical data. Between-group effects were analyzed with 1-way analysis of variance and post hoc analysis using the Scheffé test. Levene's test was used for homogeneity of the variance test and skewness and kurtosis for the distribution of data.	No statistical significance in fall frequency among the intervention and control groups.

Barker et al. (2019)	Randomized Controlled Trial	Post-discharge from two emergency departments in Australia after sustaining fall	Adults aged 60-90	Purpose: To evaluate whether a six-month intervention - RESPOND - reduced falls and fall injuries in community-dwelling older adults who presented to the ED after a fall.	An a priori sample size calculation was used for power analysis. Outcome analyses were based on intention-to-treat. Rates were calculated per person-year of exposure time and compared among groups using a negative binomial regression model. Mean differences in falls efficacy scores between groups were assessed using an independent <i>t</i> test. Differences in group characteristic proportions were evaluated using a binomial test of proportions. A significant level of $P < 0.05$ was used. All analyses were undertaken using Stata v14	Individuals in the RESPOND group sustained statistically significant fewer falls ($P = 0.042$) but not significantly fewer fall injuries compared with the control group over the 12-month period.
Iliffe et al. (2014)	3-arm parallel Cluster Randomized	Multi-Center: 43 UK-based Primary care	Adults aged ≥ 65 years who could walk independently both indoors and	Purpose: The primary objective was to determine the impact of two exercise promotion	Random-effects models to compare treatment arms to allow for	Statistically significant increase in amount of

	Trial	general practices	outdoors, and who would be physically able to take part in a group exercise class 63% of participants were female Mean BMI 27% 40% of participants had at least 3 comorbid conditions, 40% had 1 or 2 comorbid conditions, 18% reported having no comorbid conditions 35% of participants report living alone; 5% of participants were current smokers	programs on physical activity in adults ≥ 65 years compared with usual care. A secondary outcome included reduction in rate of falls. Group 1 (FaME): Weekly classes plus home exercises and encourage walking for 24 weeks Group 2 (OEP): home-based exercise only for 24 weeks + encouragement to walk Group 3: care as usual (no formal exercise instructions or classes)	clustering between practices Linear regression models for continuous outcome variables Logistic models for binary outcome variables (attainment of recommended exercise level at 12 months after the intervention) Negative binomial models for data on the rate of falls Full analysis set included all who completed at least one post-baseline assessment of the primary outcome. Those who did not attend classes were included in an intention-to-treat analysis. <i>P</i>-value <0.05 was considered statistically significant.	exercise in group 1 (FaME) compared to group 3 (usual care), but no statistical benefit for OEP compared to usual care. A statistically significant reduction in fall rates was noted in the 12 months after completion of the intervention when comparing Group 1 with Group 3. This was expressed with a 95% confidence interval (CI 0.55 to 0.99; $p=0.042$)
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Boongird et al. (2017)	Randomized Controlled Trial	Multi-center Geriatric Assessment Clinics (primary care setting) in Thailand	Adults aged ≥ 65 years with mild-to-moderate balance dysfunction 83% of participants were female Average BMI 25% 10% of participants live alone 57% of participants suffered from osteoarthritis 46% had visual impairments and 27% had hearing impairments	Purpose: To determine the effect of a home-based exercise program on falls, physical functioning, fear of falling and quality of life The intervention group engaged in five combined exercises of increasing levels of difficulty as well as a walking plan. Control: Care as usual, which included fall prevention education	Mixed-effect Poisson model was applied to compare fall rates between groups Kaplain-Meier method was applied to estimate rate and probability of falling by intervention groups Log-rank test was used to compare two falling curves Cox regression model was used to estimate the hazard ratio of falling and a global χ^2-test was used to check and test the constant of the hazard ratio. <i>P</i>-value <0.05 was considered statistically significant.	The rate of falls in the exercise group was 16% lower than the control group but this was not found to be statistically significant.
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Liu-Ambrose et al. (2019)	Randomized Controlled Trial	Single-center primary care in the Greater Vancouver area of British Columbia, Canada.	Adults aged ≥ 70 years Sex: 67% female; 33% male Mean BMI: 26.9 in exercise group, 27.1 in usual care group 40% of exercise group and 47% of usual care group live home alone Mean #falls in last 12 months: 2.3 in exercise group, 4.3 in usual care group Use of walker, brace, or cane: 27% in exercise group and 22% in usual care group Geriatric Depression Scale score, mean: 2.8 in exercise group and 3.0 in usual care group Mini-Mental-State Examination score, mean: 1.7 in exercise group and	Purpose: To determine whether a home-based exercise program would prevent subsequent falls in older adults who seek outpatient medical care following a prior fall. Intervention Group: Licensed physical therapists visited participants in the homes and prescribed exercises from an Otago Exercise Program manual and followed up biweekly for 3 additional visits to adjust the intervention. Participants were instructed to perform exercises 3 times per week and to walk for 30 minutes at least twice a week. A final visit occurred 6 months after baseline. Falls were self-reported via monthly telephone follow-up over a 12-month-period following the start of the intervention. Blinded geriatricians evaluated patients at baseline, at 6 months, and 12 months. The control group received usual care.	Primary analyses were conducted using the R statistical package, version 3.5.1 and followed the intention-to-treat principle. The primary analysis evaluated between-group differences in the number of falls of a 12-month period using Negative binomial regression model, an extension of the Poisson model that accommodates overdispersion. Post hoc analyses were conducted to determine the number of falls per person/year, the number of persons with one or more falls, and the number of fall-related fractures per person-year. Cox proportional hazards models with robust standard errors were used for post hoc analyses of time to first and second falls.	At 6 and 12month follow-ups, individuals who participated in a home-based strength and balance retraining exercise program experienced fewer falls, with statistically significant reduction in the intervention vs control group Incidence: 1.4 per person-year in the intervention group versus 2.1 per person-year in the usual care group
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			1.6 in usual care group	Outcomes were assessed by blinded assessors at baseline, at 6 months, and at 12 months.		
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Siegrist et al. (2016)	Cluster Randomized Controlled Trial	Multi-center 33 general practices in southern Germany	Adults aged ≥ 65 years Intervention male/female = 50/172 Control male/female = 43/113 Mean BMI: 27 ± 5 in both groups 44% of exercise group and 38.4% of control group live home alone 54.1% of the intervention group and 51.3% of the control group fell one or more times in the last year. Mean #falls in last 12 months: 1.3 in intervention group, 2.4 in the control group	Purpose: To determine if a 16-week falls prevention program (consisting of organized strength and balance training followed by transition to home-based exercise) in the Germany primary care setting is effective in reducing falls and related injuries in community-dwelling older adults. Intervention: 16 week supervised exercise training program (1 hour/week) with strength, power, balance, and gait exercises conducted by a physiotherapist or sports scientist and continuation of exercises through a 12-week home-based exercise program. Control: The usual care group received no structured treatment.	A generalized linear mixed effects Poisson model accounted for hierarchical structure in cluster randomized study design with individuals nested in general practices. Relative risk in interventions versus control were calculated by two generalized hierarchical linear logistic regression models.	Individuals who participated in the structured fall prevention home-based exercise program experienced statistically significant reduced falls compared to the usual care group. Incident rate ratio of falls per year was 0.54 with a 95% CI. Odds ratio of falls per person-year was 0.52 with a 95% CI.
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Mohammed et. al. (2019)	Quasi Experimental Intervention Study	Single-center Family Medicine Center in Egypt	Adults aged 60 years or older who were attending the Fanara Family Medicine Center. 66% of the subjects were female 63% had fallen within the last year Mean BMI: 26.9	Purpose: To evaluate the effect of multifactorial, individualized interventions for fall prevention among elderly persons. Interventions: An individualized assessment, education, prescription, and modification of treatment at their primary care center, an assessment and management of bone health, an assessment of home hazards and modification of these hazards, and participation in the home based Otago Exercise program. The evidence-based, Otago exercise program, was assigned to the participants and had to be followed three times a week combined with 30 minute walking. Participants were assessed for falls on a monthly basis for 12 months. Control: None	The Statistical Package for Social Sciences (SPSS), version 20 was used to analyze data. The Shapiro-Wilk test was used for continuous data. Difference in functional status, strength, and balance abilities were detected as continuous data over three time point using Friedman's tests and post hoc analysis using the Wilcoxon signed-rank test. Categorical data across these three time points was compared using Cochran's Q, with post hoc analysis performed using McNemar's test.	There were statistically significant differences in the rate of falls ($P = 0.049$) and recurrent falls ($P = 0.011$) among subjects from baseline to 12 months post-intervention.
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Dadgari et al. (2016)	Randomized Controlled Trial	Multi-center public health centers in Shahroud, Iran	Adults 60 years or older who experienced a fall within the past 12 months Mean age: 70 Mean BMI:: 27	Purpose: To determine the effectiveness of the home-based Otago exercise program to reduce falls among community-dwelling older adults in Shahroud, Iran. Intervention: Participation in the home based Otago exercise program (OEP) which included strengthening and balance exercises three times weekly, for 6 months. Control: usual care and general health education.	Descriptive and inferential statistics were performed via SPSS version 21 to analyze the data and the mean, standard deviation, and frequency of variables were determined. -t-Test and x2 applied in inferential statistical methods. Statistical significance was defined at $P < 0.05$. Normality of the results was tested by skewness of ± 1. Results were normally distributed	There was a statistically significant reduction in the incidence of falls ($P \leq 0.00$), improved physical performance (Berg-Balance-Score with $P > 0.025$, and Timed-Up-GoTest with $P > 0.017$) and functional capacity (Arm-Curl-Test with $P > 0.00$ and Chair-Stand-Test with $P > 0.01$) in the intervention group.
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El-Khoury et al. (2015)	Randomized Controlled Trial	20 community center sites in France	Women aged 75-85, who have diminished balance and gait capacities but still reside in their own home.	Purpose: To determine the effect of a two-year exercise and balance program in reducing injurious falls among women aged 75-85 who have diminished balance and gait capacities but still reside in their own home. Intervention: Supervised group sessions of progressive balance retraining offered in the community on a weekly basis for two years, supplemented by individually prescribed home-based exercise. Control: Usual care	The authors used a shared frailty model to take dependency of events within an individual (correlation between different falls by the same person) into account.	Women in the intervention group performed significantly better on physical tests and had significantly better perception of their overall physical function than women in the control group. The intervention group showed a statistically significant reduction in the rate of falls with injury (95% CI, 0.67 to 0.99, P=0.04) There were fewer falls among the intervention group (533) compared to the control (640) but it was not statistically significant (0.88, 0.77 to 1.00, P=0.05).
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Gallo et al. (2018)	Randomized Controlled Trial	Rusk Rehab at NYU Langone Medical Center's ambulatory care center	Independent community dwellers were 65 years and older who had difficulty walking. 30 subjects were male and 39 subjects were female.	Purpose: To investigate if a structured balance exercise program can decrease the risk for falls or fall rates, whether a home-based program would be more effective than usual ambulatory physical therapy care at Rusk Rehabilitation, and if adding four consult visits after discharge from physical therapy every two to four weeks would increase compliance with the home-based exercise program. Intervention: Structured individualized home exercise programs. In order to individualize home exercise programs, members in the experimental group completed a mini-balance evaluation systems test (mini-BEST) to identify neurological subsystems that may affect balance. 120 minutes of home exercises were completed each week over 26 weeks (50 hours total) in 6 months.	A random-effects model was used to compare and analyze outcome measures between the intervention and control groups over time, adjusted for the number of risk factors. A Poisson random effect model and regression analysis, adjusted for number of risk factors and baseline measures, and a negative binomial random effect model, were used to compare the number of falls between groups. All analyses were used a significance level of 0.05 using 2-sided tailed tests	Results showed that, while both groups had a significant reduction in fall risk, the experimental program was significantly more effective than usual care ($P < 0.05$). The number of falls did not change significantly for either group despite the aforementioned reduction in fall risk.
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				Control: Members of the control group received the usual physical therapy, which consisted of 30 to 60 minutes of individual sessions 1 to 2 times per week.		
Suttanon et. al. (2018)	Randomized Controlled Trial	Community based clinics in Thailand.	Adults over the age of 60, mostly females living in the community in Thailand who have the ability to walk with no more than one support, having no serious orthopedic conditions and neurological disorder	Purpose: Determine the effectiveness of home-based falls prevention program, focusing on balance exercise programs on falls and falls risk factors including physical performance in community dwelling older people in Thailand. Intervention: Four-month multifactorial falls prevention program which focused on a balance training exercise. All participants were provided a booklet with illustrations, fall management strategies and how to deal with their fall risk factors.	All analyses were conducted using intention to treat principle and to evaluate the effectiveness of the program generalized linear models (SPSS advanced statistics 17.0) was used.	No significant reduction in falls. The intervention group had a mean increase of ~ 1 second in the Timed up and go test (TUG) compared with the control group. The intervention group had a greater number of home environmental hazards than the control group. No changes and no differences between the groups were found in the

				Control: The control group participants received usual care and continued their usual activities without any of the limitation from being participated in the study.		majority of the other outcome measures.
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Patil et al. (2015)	Randomized Controlled Trial	Finnish women between age 70-80 living independently in Tampere, Finland	Women between age 70-80, home dwelling who had fallen once within the past 12 months, did not use vitamin D supplements, spends < 2 hrs exercising per week and without contraindication to exercise.	Purpose: determine effectiveness of a multicomponent exercise on physical functioning, falls and related injuries in community dwelling women aged 70-80. Intervention: group exercise classes twice a week for the first 12 months and once a week for the subsequent 12 months. Sessions in the exercise hall focused on balance, weight bearing, strengthening, agility and functional exercise. The exercisers also had a home training program. Control: Maintained baseline physical activity	For physical function outcomes group differences in time were estimated using linear mixed models for normally distributed outcomes and generalized linear mixed models with gamma distribution and log link function for non-normally distributed Data analysis was conducted using SPSS version 22 and intention to treat principle.	There was no significant difference between groups in the total falls incidence rate ratio (95% CI= 0.79-1.26, P=.98) There were significantly fewer medically attended fall injuries with CI of 0.45(0.27-0.78)in the exercise group. Physical performance scores in exercisers improved during the intervention. Isometric leg extension strength improved significantly in exercisers (P<.001) with a mean difference of 15.5% between the groups at 18 months.
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Voukelatos et al. (2015)	Randomized Controlled Trial	Community dwelling people aged 65 years and over from the greater Sydney region, Australia	Community dwelling adults ≥ 65 years, inactive (i.e. < 120 min of exercise per week); mobile (i.e. able to walk at least 50 m with minimal aid); and able to communicate in English N= 386. 74% of the subjects were female (n = 285)	Purpose: To investigate the impact of a 48-week walking program on falls in older people Intervention: Self-paced, 48-week walking program that involved three mailed printed manuals and telephone coaching. Control: The control group were mailed information about health issues (nutrition, sleeping habits and mental health) at the same time the intervention group received their walking manuals. Control group participants were contacted via telephone at the same points in the study as intervention group participants to discuss the health information sent. At the end of the study control group participants were sent the walking program materials	Stata IC version 12.2 according to intention to treat principles, analysis for faller-non faller and non multiple-multiple faller comparisons used relative risk statistic	Walking program was found to be ineffective at preventing falls and questions the suitability of recommending walking as a fall prevention strategy for older people. There was no significant difference in fall rates between the two groups (95% CI: 0.60–1.29; $P = 0.52$), as well as no significant differences in the proportion of fallers or recurrent fallers between the groups.
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Gill et al. (2016)	Randomized Control Trial	United States, across multiple cities	Community dwelling adults 70- 89 years old who were sedentary with some functional limitations but able to participate in physical activity, who were at increased risk of falling	Purpose: To test whether a long term, structured moderate intensity physical activity program is more effective at prevention of injurious falls than a health education program that reviews exercises and stretching with older adults Intervention: A structured, moderate intensity physical activity program conducted in a center (twice a week) and at home (3-4 times a week) that included aerobic, strength, flexibility, and balance training activities Control: Health education program consisting of workshops on topics relevant to older people and upper extremity stretching exercise	Estimated hazard ratios with 95% confidence intervals and used likelihood ratio tests from Cox proportional hazards regression models, with the baseline hazard stratified by sex All analyses were performed in SAS (SAS Institute), version 9.4	No statistically significant difference was found between the rate of serious falls causing injury between groups.
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Li, et al (2018)	Randomized control trial	Urban and suburban cities in Oregon	Community dwelling adults ≥ 70 who were at high risk for falls, fall within previous year or had impaired mobility. 65% of the participants were women.	Purpose: To compare effectiveness of tai chi, multi modal exercise and stretching on fall prevention in a high-risk senior population Intervention: One of 2 exercise interventions: 2 60-minute tai chi classes per week for 24 weeks or multimodal exercise encompassing balance aerobics, strength, and flexibility activities Control: Stretching exercises	Primary analysis of falls count outcome, negative binomial regression was used to estimate absolute differences in IRRs with their corresponding 95% CIs comparing Tai Chi and MME with stretching exercises. Analyses were conducted using SPSS version 23(IBM Corp) or Stat (release 13; Stata-Corp LP)	At 6 months, incidence rate ratio (IRR) was significantly lower in the Tai Chi (IRR, 0.42; 95% CI, 0.31-0.56; $P<.001$) and MME groups (IRR, 0.60; 95% CI, 0.45-0.80; $P=.001$) compared to stretching groups. Falls were reduced 31% for the Tai Chi group compared with the MME group (IRR, 0.69; 95% CI, 0.52-0.94; $P=.01$)
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