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| **CRITICALLY APPRAISED TOPIC** |

**FOCUSED CLINICAL QUESTION**

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| In older adults with a history of falls and living in long-term care facilities, is exercise more effective than no prescribed exercise program for reducing fall risks?  |

**AUTHOR**

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| **Prepared by** | Diandrea McCotter, PT | **Date** | November 2014 |
| **Email address** | Diandrea.mccotter@med.unc.edu |

**CLINICAL SCENARIO**

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| Falls affect one-third of people over the age of 65, and are the leading cause of injury in that age group, according to the Centers for Disease Control and Prevention.4Staying active can slow progression of muscular degeneration, extend mobility, and reduce the likelihood of falls. Physical inactivity, as people age can contribute to obesity, hypertension, heart disease, osteoporosis, diabetes, depression, and anxiety as well as limited mobility.4,9The institutionalized elderly are high-risk patients. The loss of functional mobility has been shown to be associated with 50 percent mortality rate among nursing home patients within 6 to 12 months.5 Evidence from several studies indicates that this decline in physical functionality as such is due only partly to the aging process, and to a large extent, it is due to the decrease in or lack of physical activity.9After a recent Cochrane review, the role of physical exercise on falls prevention in long term care residents has been questioned.6 A previous meta-analysis evaluated the effectiveness of interventions designed to reduce falls and risk of falling (exercises, medication, vitamin D supplement, environment, staff training) in older people living in both long term care facilities and hospital settings comparing each population separately.6 The authors concluded that multifactorial interventions reduce falls and risk of falling in hospital and could have a similar preventive effect in long term care facilities.6 |

**SUMMARY OF SEARCH**

[Best evidence appraised and key findings]

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| * Seven randomized controlled trials met the inclusion/exclusion criteria listed below. Three of the highest appraised studies were reviewed.
* The evidence supported the implementation of multifactorial fall prevention program that includes exercises and task-specific balance activities reduce the risk of falls and improve balance.
* Key points for future research include: having specifically tailor-made exercises instead of group exercises or a standard protocol, addressing cost-effectiveness, and exploring other components such as strength and endurance to reduce the risk of falls.
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**CLINICAL BOTTOM LINE**

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| Among older people living in residential care facilities, almost two-thirds fall each year and they experience falls three times more frequently than older people living in the community. In addition, the incidence rates for both fall-related major soft tissue injuries and fractures are more than twice as high for this group of older people.4 Therefore, this population should be engaged in a multi-factorial fall prevention program the incorporates exercises and task specific balance activities.  |

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| ***This critically appraised topic has been individually prepared as part of a course requirement and has been peer-reviewed by one other independent course instructor*** |

*The above information should fit onto the first page of your CAT*

**SEARCH STRATEGY**

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| **Terms used to guide the search strategy** |
| **P**atient/Client Group | **I**ntervention (or Assessment) | **C**omparison | **O**utcome(s) |
| older adult\* aging OR ageing OR agedelderlyresidential facilit\*skilled nursing facilit\*  institutionalized "nursing home” | ExerciseExercise TherapyPhysical ActivityRehabilitationExercise ProgramPhysical Therapy OR physiotherapy | N/a | Fall Risk OR fallAccidental FallsAmbulationWalkingPostural BalanceMobility Limitation |

**Final search strategy:**

*Show your final search strategy from one of the databases you searched. In the table below, show how many results you got from your search from each database you searched.*

PubMed (n=114)

|  |  |  |
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| Search | Query | Items found |
|  #15 | Search (((((((("Accidental Falls"[Mesh]) OR "Mobility Limitation"[Mesh]) OR postural balance OR fall)))) AND ((((((older adult\* OR aging OR ageing OR elderly))))) AND (((residential facilit\* OR skilled nursing facilit\* OR institutionalized OR "nursing home"))))) AND (((exercise OR physical therapy OR physical activity OR exercise program OR physiotherapy OR exercise therapy))) Filters: Full text; published in the last 10 years | 114 |
| #14 | Search (((((((("Accidental Falls"[Mesh]) OR "Mobility Limitation"[Mesh]) OR postural balance OR fall)))) AND ((((((older adult\* OR aging OR ageing OR elderly))))) AND (((residential facilit\* OR skilled nursing facilit\* OR institutionalized OR "nursing home"))))) AND (((exercise OR physical therapy OR physical activity OR exercise program OR physiotherapy OR exercise therapy)))  | 189 |
| #13 | Search (((((((("Accidental Falls"[Mesh]) OR "Mobility Limitation"[Mesh]) OR postural balance OR fall)))) AND ((((((older adult\* OR aging OR ageing OR elderly))))) AND (((residential facilit\* OR skilled nursing facilit\* OR institutionalized OR "nursing home"))))) AND (((exercise OR physical therapy OR physical activity OR exercise program OR physiotherapy OR exercise therapy))) Filters: Full text | 161 |
| #12 | Search ((exercise OR physical therapy OR physical activity OR exercise program OR physiotherapy OR exercise therapy)) | 635400 |
| #11 | Search ((residential facilit\* OR skilled nursing facilit\* OR institutionalized OR "nursing home"))) | 33458 |
| #10 | Search (((((older adult\* OR aging OR ageing OR elderly))) | 4258227 |
| #9 | Search (((("Accidental Falls"[Mesh]) OR "Mobility Limitation"[Mesh]) OR postural balance OR fall)) | 158975 |

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| #8 | Search ((("Accidental Falls"[Mesh]) OR "Mobility Limitation"[Mesh])) AND ((((older adult\* OR aging OR ageing OR elderly)) AND (residential facilit\* OR skilled nursing facilit\* OR institutionalized)) AND (exercise OR physical therapy OR physical activity OR exercise program)) | 46 |
| #7 | Search ("Accidental Falls"[Mesh]) AND "Mobility Limitation"[Mesh] | 224 |
| #6 | Search (((older adult\* OR aging OR ageing OR elderly)) AND (residential facilit\* OR skilled nursing facilit\* OR institutionalized)) AND (exercise OR physical therapy OR physical activity OR exercise program) | 644 |
| #5 | Search (((older adult\* OR aging OR ageing OR elderly)) AND (residental facilit\* OR skilled nursing facilit\* OR institutionalized)) AND (exercise OR physical therapy OR physical activity OR exercise program) | 537 |
| #4 | Search (((older adult\* OR aging OR ageing OR elderly OR skilled nursing facility OR nursing home)) AND (exercise therapy OR exercise\* OR physical activity OR ambulation OR fall risk OR falls) | 180146 |
| #3 | Search (((older adult\* OR aging OR ageing OR elderly OR skilled nursing facility OR nursing home)) AND (exercise therapy OR exercise\* OR physical activity OR ambulation OR fall risk OR fall\*) | 204490 |
| #2 | Search (("Skilled Nursing Facilities"[Mesh]) AND "Residential Facilities"[Mesh]) AND "Nursing Homes"[Mesh] | 3640 |
| #1 | Search (older adult\* OR aging OR ageing OR elderly OR skilled nursing facility) | 4259675 |

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| **Databases and Sites Searched** | **Number of results** | **Limits applied, revised number of results (if applicable)** |
| **PubMed****PubMed****PubMed****CINAHL****CINAHL****Cochrane****Cochrane** | **114****67****39****30****27****523****37** | **English & Humans, full text, clinical trial, review, Published with 10 years****English & Humans, full text, clinical trial, review, Published within 5 years****English & Humans, full text, clinical trial, Published within 5 years****Full Text, English language****Published within past 10 years, Full text****Trials****Trials, published within the last 5 years** |

## INCLUSION and EXCLUSION CRITERIA

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| **Inclusion Criteria** |
| * Studies that included older adults (at least 60 years old) who were institutionalized
* Studies published in English
* Studies that measure fall risk
* Studies that included moderate-high intensity exercise as an intervention
* Studies that are randomized controlled trials, uncontrolled trials, controlled trials, or systematic reviews
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| **Exclusion Criteria** |
| * Studies published before 2000
* Studies that did not include physical activity or balance activities as an intervention
* Studies that include older adults who are community dwellers who are not institutionalized
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**RESULTS OF SEARCH**

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| A total of  | \_7\_\_ | relevant studies were located and categorised as shown in the following table (based on Levels of Evidence, Centre for Evidence Based Medicine, 2011) and **PEDro Scale** quality assessment rating scale |

**Summary of articles retrieved that met inclusion and exclusion criteria**

*Note that this table is arranged differently from the example CAT on Sakai. For each article that meets your inclusion and exclusion criteria, score for methodological quality on an appropriate scale, categorize the level of evidence, and note the study design (e.g., RCT, systematic review, case study). Add more rows as necessary.*

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| **Author (Year)** | **Study quality score** | **Level of Evidence** | **Study design** |
| **Jensen et al (2002)** | **6/10** | **2b** | **Randomized Controlled Trial** |
| **Dyer et al (2004)** | **7/10** | **1b** | **Randomized Controlled Trial** |
| **Rosendahl et al (2008)** | **7/10** | **2b** | **Randomized Controlled Trial** |
| **Rugelj (2010)** | **5/10** | **2b** | **Randomized Controlled Trial** |
| **Dal Bello et al (2012)** | **6/10** | **2b** | **Randomized Controlled Trial (prospective)** |
| **Tsaih et al (2012)** | **5/10** | **4** | **Randomized Controlled Trial** |
| **Gronstedt et al (2013)** | **6/10** | **2b** | **Randomized Controlled Trial** |

**BEST EVIDENCE**

The following 3 studies were identified as the ‘best’ evidence and selected for critical appraisal. Reasons for selecting these studies were: These 3 studies all were the closest to matching my PICO question and met my inclusion/exclusion criteria. The studies scored between 5-7 out of 10 points of the PEDro scale

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| * Dyer, C. A. E., Taylor, G. J., Reed, M., Dyer, C. A., Robertson, D. R., & Harrington, R. (2004). Falls prevention in residential care homes: a randomised controlled trial. *Age & Ageing*, *33*(6), 596–602. –
* Rugelj, D. (n.d.). The effect of functional balance training in frail nursing home residents. *Archives of Gerontology and Geriatrics*, *50*(2), 192–7. doi:10.1016/j.archger.2009.03.009-
* Jensen J, Lundin-Olsson L, Nyberg L, Gustafson Y. Fall and injury prevention in older people living in residential care facilities: A cluster randomized trial. *Ann Intern Med*. 2002;136(10):733-741.
 |

**SUMMARY OF BEST EVIDENCE**

**(1) Description and appraisal of Falls prevention in residential care homes: a randomised controlled trial by Dyer et al. (2004).**

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| **Aim/Objective of the Study/Systematic Review:** |
| * The objective of this study was to “conduct a cluster randomized controlled trial to determine whether the number of falls/ recurrent falls in older adults in residential homes could be reduced through a comprehensive program of risk factor assessment and intervention, including progressive exercise.” (Dyer et al, 2004, p. 596)
 |
| **Study Design**[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]Note: For systematic review, use headings ‘search strategy’, ‘selection criteria’, ‘methods’ etc. For qualitative studies, identify data collection/analyses methods. |
| * A cluster randomized controlled trial was conducted with multifactorial fall prevention program including 3 months gait-balance training, medication review, environmental check, staff education, podiatry and optometry.
* Written consent was received from the participants. Baseline assessments of all 196 participants were directed by a physical therapist, nurse, and occupational therapist who were masked to allocation. This was done prior to the participants being randomized into groups. The assessments were repeated 3 months later by the same team who also did not participate in the intervention portion of the study. The falls data was collected until 1 year after the first assessment date.
* The assessment consisted of a determination of overall functional mobility that included personal details of the residents, a Barthel ADL Index, and an Abbreviated Mental Test Score. It also included more specific fall risk factors and tests such as polypharmacy, orthostatic hypotension, the Timed Get Up and Go Test (TUG), Tinetti gait balance score, observation of the condition of the resident’s feet and footwear and visual acuity.
* A researcher independent of the study completed a computer-generated allocation sequence of the participants’ homes which were developed into number tables with the homes ordered alphabetically into odd and even numbers and according the home size. The independent researcher was also blinded to the baseline assessment results.
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| **Setting**[e.g., locations such as hospital, community; rural; metropolitan; country] |
| Participants were recruited from 20 residential care homes in Western Wiltshire. Services from the physical therapists, an occupational therapist assistant, geriatricians, optometrist, and podiatrist were administered at the residential care homes. |
| **Participants**[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article. |
| * 196 residents were randomly allocated into the intervention (n=102; 81 females and 21 males) and control group (n=94; 72 females and 22 males) both with a mean age of 87.4 years old.
* In the intervention group, 13 were lost to follow-up resulting in 89 participants who completed the study. In the control group, 11 were lost to follow-up resulting in 83 actual participants.
* All residents were mostly independent with functional mobility however, meals were provided and care assistants were available to assist with ADLs and miscellaneous activities as needed. They also lived in their own private rooms but shared communal areas.
* Participants had to be at least 60 year olds residing in single registered residential care homes in Western Wiltshire that had a minimum of five residents (median size of 20 residents per home) that was not considered a nursing facility or did not provide care to the mentally ill. Short-term residents and those suffering from terminal illnesses were also excluded from the study.
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| **Intervention Investigated**[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided] |
| *Control* |
| Residents in the control group received no intervention throughout the duration of the study. The participants were followed by the research assistant every 3 weeks to ensure that the participants were compliant about documenting any falls in their fall record diaries and accident books. |
| *Experimental* |
| * The intervention group received a multifactorial risk factor modification program by physical therapists and exercise assistants for 12–14 weeks. The programs consisted of: an exercise program, staff education, medical reviews, environmental modification and optometry and podiatry assessments 3x/week.
* Exercise Program: The physical therapist conducted the circuit exercise program by household groups for 40 minutes each session. The program often consisted of dancing, games that encouraged volitional to automatic action and movement, and resistive exercises with thera-bands or small weights.
* Staff Education: Written information about the study goals/objectives were issued to each care home manager that encouraged staff involvement in the intervention. Each home also received a home information packet detailing the exercise program and fall prevention strategies.
* Medical Review: two geriatricians reviewed the baseline assessment records of each resident screening for those with suspected medical risk factors. The geriatricians examined the at-risk residents reported their medical recommendations to the participants’ primary physicians.
* Environmental Modifications: An occupational therapy assistant visited each home and provided a written assessment and intervention of each home with specific risk factors that could lead to falls in the home.
* Optometry and Podiatry: The study team scheduled an optometrist to visit residents who had not seen an optometrist within a year or those with a visual acuity of 6/12 or less. A podiatrist was prearranged for those who had baseline foot conditions during the initial assessments
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| **Outcome Measures** (Primary and Secondary)[Give details of each measure, maximum possible score and range for each measure, administered by whom, where] |
| * *Primary outcome* measures were the total number of falls and frequent falls of at least three or more per resident that occurred in the year after the baseline assessment. *Secondary outcomes* included medical factors such as the amount of oral medications taken per resident, visual acuity, and the conditions of the residents’ feet/footwear. Gait and balance results were additional secondary outcomes that included: an overall change in the Tinetti gait and balance score, TUG score, Timed Unsupported Stand score (TUSS), right/left leg stand, 180 degree turn, and the number of falls that resulted in injury. (Dyer et al, 2004, p. 597)
* Each resident recorded their falls in a fall diary, which they began documenting in 3 months prior to the baseline assessment. A research assistant visited the residents’ homes every 3 weeks to obtain information from their individual fall diaries for up to one year after the initial assessment date.
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| **Main Findings**[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided – if you need to calculate these data yourself, put calculations here and add interpretation later, under ‘critical appraisal’ on next page] |
| * The intervention group, as a whole, had no reduction in the number of residents falling after 1 year
	+ 56 of the 102 residents (54.9%) in the intervention group fell compared with 51 of the 94 (54.3%) residents in the control group [OR 1.03; 95% confidence intervals (CI) 0.59–1.80]. (Dyer et al. 2004, 598)
	+ There were 194 falls in the intervention group and 266 in the control group. The rate of falls was reduced at 2.2 (1.3, 3.0) in the intervention group compared with 4.1 (2.3, 5.7) falls per person per year in the control group, but this difference failed to reach statistical significance (ICC 0.10; P =0.27). (Dyer et al. 2004, 598)
* The residents in the control group had more recurrent falls (26.6%) than the intervention group (25.5%) [OR 0.94; CI 0.50-1.79]. However, the intervention group reported more injurious falls (3.9%) than the control group (3.2%) [OR 1.23; CI 0.27-5.63]
* At 1 year, 80 residents in the intervention group had seen an optometrist compared with 48 controls (P<0.001, Chi squared test), and 60 residents in the intervention group had seen a podiatrist compared with 33 controls (P<0.001). (Dyer et al. 2004, 598) However, this did not result in improved vision (p=0.118) or improved feet conditions (p=0.123).
* The intervention group did have a significant improvement (p<0.05) in secondary outcomes of gait and balance results from baseline to 3 months for the following: 180 degree turn (p=0.006), Right leg stand (p=0.025), Left leg stand (p=0.011), Tinetti gait score (p=0.044), Tinetti balance score (p=0.003), and Tinetti total score (p=0.001). The TUG score (p=0.187) and TUSS score (p=0.187) had a significant decline in improvement for gait and balance results.
* The control group had risk factors that worsened or showed no improvement throughout the 3-month assessment were: 180 degree turn (p=0.205), TUG score (p=0.088), Right leg stand (p=0.445), Left leg stand (p=0.136), Tinetti Balance Score (p=0.824), and Tinetti total score (p=0.317)
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| **Original Authors’ Conclusions**[Paraphrase as required. If providing a direct quote, add page number] |
| Risk factor modification and balance exercises reduced the risk of falls for residents in residential care homes however, the results failed to reach statistical significance. Undergoing a multi-factorial fall prevention program can improve risk factors related to gait, balance, and medical impacts such as polypharmacy, orthostatic hypotension, vision, and feet conditions.  |
| **Critical Appraisal** |
| **Validity**[Methodology, rigour, selection, sources of bias, quality score on methodology quality rating scale (indicate the quality assessment tool used and the maximum possible score on that scale, e.g., 7/10 on PEDro scale), appropriateness of analytical approach (e.g., adjustments for confounding variables, management of missing data).]Comment on missing information in original paper. |
| The PEDro scale was used as the quality assessment tool for this study scoring a 7/10. The study loses credibility because it failed to blind the subjects, who were all in groups and lived together in the same house; the therapists who administered the therapy; and the assessors who measured the outcome measures. The avoid potential bias, the authors could have blinded the one therapist who administered the therapy and the assessors. It is understandable that it was difficult to blind the subjects being that the intervention was given to the residents in their homes in an effort to increase compliance. Consider the bias of the self-reported falls. The study does not mention what was considered the official definition of a “fall” leaving it to the discretion of the residents. For example, a resident who suffers from a mechanical fall is unable to assist themselves to standing may consider that a fall. However, another resident who falls but is able to assist themselves to standing may not consider that a fall. Additionally, we have to assume all participants were being honest even though there was someone who provided follow-up every 3 weeks in an effort to promote compliance. Also, the exercise protocol was not detailed in the study. The study mentioned a circuit training exercise program done 40 minutes 3x/week but failed to mention the amount of repetitions, sets, or type of resistance used with each exercise. Moreover, the exercise intervention was given in groups and there was not a strict protocol of exercises provided each session or how the specific exercise protocol was developed to relate to balance deficits. The progression of the participants was left up to the discretion of one therapist which could potentially.  |
| **Interpretation of Results**[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference. You may calculate effect size or confidence intervals yourself from the data provided in the article.] Describe in your own words what the results mean. |
| * The study shows that that there was evidence in a reduction in falls in those who participated in the fall prevention program however, the numbers were not statistically significant.
* Clinical significance related to the study suggests that although risk factors for falls can be reduced, the number of falls, risk of recurrent falls, and risk of fracture from a fall is not reduced by this intervention which raises doubts about the clinical significance of the effect on reduction of fall risk. However, the intervention group did have an improvement in gait in balance from balance outcomes even though that did not translate to a reduction of falls.
* Having a multi-faceted risk factor modification program was not superior to not having no intervention at all.
* Additionally, the medical pre-screening for risk factors and medical examination by the podiatrist and optometrist did not translate into improved visual acuity, or an improved condition of feet or footwear in which neither aided in improving the risk of falls.
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* **(2) Description and appraisal of The effect of functional balance training in frail nursing home residents by Rugelj et al. (2009)**

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| **Aim/Objective of the Study/Systematic Review:** |
| “The purpose was to design and evaluate the set of exercises that would specifically target functional balance and would challenge most of the aspects of the balance performance: reaching borders of stability, balancing on compliant surface, stabilizing during head movements and dual attention.” (Rugelj et al, 2008, p. 193) |
| **Study Design**[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]Note: For systematic review, use headings ‘search strategy’, ‘selection criteria’, ‘methods’ etc. For qualitative studies, identify data collection/analyses methods. |
| * A randomized controlled trial was conducted on 50 nursing home residents who were randomly allocated from two nursing homes to a control group (n=17) and experimental group (n=33).
* A baseline assessment of all 50 participants in both nursing homes was done based on the Sensory organization test and functional tests (Four square test, Ten meter walk test, Berg Balance Scale and Barthel Index). These tests were repeated after 12 weeks. A one-way ANOVA was done to determine if the two experimental groups from both nursing homes had statistically significant differences that would hinder the authors from combining the experimental group from the two separate nursing homes into one group
* The experimental group underwent a 12-week training protocol that included functional activities for balance training
* Statistical analysis was measured using the Statistical Package for Social Sciences. Paired t-test assessed within the group differences between the initial and final measurements. A two sample t-test was calculated for between-group analysis
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| **Setting**[e.g., locations such as hospital, community; rural; metropolitan; country] |
| Residents of two public nursing homes located in two small towns participated in the study. The two nursing homes are a part of national public association of nursing homes and meet national care standards (Rugelj et al, 2008, p.193) The actual location was not mentioned in the study or exactly where the training took place i.e. multicultural gym in nursing home. |
| **Participants**[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article. |
| * Out of 358 residents from both nursing homes, 145 individuals met the inclusion criteria with 59 consenting to participate
* To be included in the study, the participants had to be frail but independently mobile subjects and residents of the nursing home without neurological, cardiovascular, or musculoskeletal conditions that would interfere with functional mobility.
* Initially there were 39 residents from the first nursing home who were randomly allocated to an experimental group (n=20) and control group (n=19) with the remaining residents in the second nursing home (n=20) placed in another experimental group. However, 7 participants in the experimental group dropped-out after the first two weeks therefore, the authors excluded the two oldest participants in the control group so that there would not be a significant age difference between the two groups
* After determining that there were no statistically significant differences between the two experimental groups, the authors combined the two experimental groups from both nursing homes into one group.
* The final number of participants: experimental group (n=33; 24 females and 9 males; age 75.7±6.7 years)
 |
| **Intervention Investigated**[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided] |
| *Control* |
| Residents in the control group did not perform any additional exercise activity and received no intervention throughout the duration of the study. |
| *Experimental* |
| * The experimental group underwent a 12-week training protocol 5x/week. The protocol consisted of 14 functional activities for balance that measured various components of balance on different levels and was set-up as stations in the nursing home. The residents performed the exercises in the same order every time. Initially, the number of repetitions started at 6 and gradually increased to 10 repetitions by the 5th week and to 15 repetitions by the 7th week.
* The functional balance exercises were divided into 5 groups. The first group required head and body rotation around the vertical axis. These activities included: Turning back with axial rotation, Retrieving an object from the floor, standing up, and walking around a chair without touching it. The second group demonstrated a shift of the center of gravity to the border of stability. These activities included: Reaching an object beyond arm length, turning around 360 degrees, and reaching forward with an object in hand. The third group required walking over obstacles or on a narrow base of support. These activities included: Walking across obstacles that were 8cm high, walking with a glass full of water, and Tandem walking. The fourth group required exercises with soft supporting surfaces. Theses activities were stepping, walking or, standing on a compliant surface. The fifth group was stair negotiation.
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| **Outcome Measures** (Primary and Secondary)[Give details of each measure, maximum possible score and range for each measure, administered by whom, where] |
| * All tests and measures used in this study have been deemed valid and reliable clinical tools in previous literature. Each outcome measure was administered to all 50 participants during the initial assessment and after 12 weeks.
* The sensory organization test was used to address impairments and consists of 4 timed sensory components: standing on a solid surface with eyes opened and with eyes closed; standing on a compliant surface with eyes opened and eyes closed.
* The timed four square step test assesses agility, directional changes, weight shifting, and ability to step over objects using two 1cm bars set perpendicular to make four squares. The residents were asked to move from one square to the fourth square as quickly as possible. A decrease in time to complete the task shows improvement.
* The ten meter walk tests assess overall functional mobility and consists of timing the residents walking down 10 meters and back without stopping. A decrease in time to complete this task shows improvement.
* The Berg balance scale (BBS) involves 14 functional activities graded on a scale from 0-4. The residents were asked to perform each activity in order from least demanding to most demanding. A higher number was given to those who could perform the more demanding activity.
* The Barthel Index (BI) is an ordinal scale that measures functional independence and activities of daily living. Total possible scores range from 0 – 20, with lower scores indicating increased disability and higher scores indicating increased independence of daily activities.
* 20 residents from the second nursing home participated in the stabilometric test on a force platform. The residents were asked to stand as still as possible on a force platform with feet together and arms down by their sides with eyes closed and open. This gave a measurement of the amount of body postural sway and center of pressure (CoP),
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| **Main Findings**[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided – if you need to calculate these data yourself, put calculations here and add interpretation later, under ‘critical appraisal’ on next page] |
| * Sensory organization test: After the 12 week training protocol, there was no difference in pre to post-treatment tests for a portion of the Sensory organization test (standing on solid surface with eyes opened and closed). However, for the second portion of the sensory organization test (standing on compliant surface with eyes opened/closed) the participants were able to stand 19.1 ± 21.5 s longer with eyes open than with closed eyes 17.7 ±16.6 s after the training protocol which was found to be statistically significant (p=0.01 and p=0.02). The control group’s differences pre and post assessment were deemed not to have statistically significant differences (p<0.001)
* Four square test: The participant’s time decreased from 19.4 ±6.3 s before treatment to 14.1± 3.9 s after treatment (p < 0.001). The control group indicated no significant differences in comparison to the first (20.05±5.9s) and second (18.89±8.7s) assessment.
* Ten Meter Walk Test: The participants’ time decreased from 12.1 ±3.3 s before treatment and 9.4 ±2.9s after treatment (p < 0.001). The control group showed no statistically significant differences in comparison to the first (12.44±4.9s) and second (13.05±5.9s) assessment.
* Berg balance scale: BBS scores increased significantly after treatment (44± 5 scores before treatment and 51± 4 scores after treatment); p=0.001. The control group also showed statistically insignificant differences between the first and second assessment (47±6 and 49±6 respectively).
* Barthel Index: There was no statistically significant change in functional independence (p=0.83). The control group and identical results pre and post assessment.
* A t-test analysis was done to calculate the differences between the initial and final assessment between the control and the experimental group. The results showed significant improvement for the experimental group in comparison to the control group. P<0.001 for BBS, ten meter walk tests, and four square test; p<0.01 for standing on compliant surface with eyes closed.
* Stabilometry: The 20 nursing home residents showed no difference in sway pre and post assessment.
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| **Original Authors’ Conclusions**[Paraphrase as required. If providing a direct quote, add page number] |
| The authors of the study concluded that implementing a 12-week balance training protocol for older adults emphasizing exercises similar to every day activities resulted in significant improvements in balance in comparison to the control group who did not show any change. The authors suggest that task-specific balance training can be more readily transferred into daily life thus improving balance and reducing the risk of falls.  |
| **Critical Appraisal** |
| **Validity**[Methodology, rigour, selection, sources of bias, quality score on methodology quality rating scale (indicate the quality assessment tool used and the maximum possible score on that scale, e.g., 7/10 on PEDro scale), appropriateness of analytical approach (e.g., adjustments for confounding variables, management of missing data).]Comment on missing information in original paper. |
| The PEDro scale was used as the quality assessment tool for this study and scored 5/10. The authors did not mention concealed allocation during the randomization process. To reduce bias, a system must be in place to ensure that subjects, investigators, and involved health care providers are unaware to which group a subject will be allocated before that subject is entered into the study. If the next group to which a subject will be allocated is known, either by there being no effort to conceal it or by deciphering the randomization scheme, the RCT potentially becomes a non-randomized trial. Additionally, the subjects, outcome assessors, the clinicians were not masked during the study. Masking of study personnel assessing outcomes could potentially strengthen their objectivity. Subjects who are unmasked are more likely to alter their behavior of key study outcomes if they know their assignment. Masked subjects are more likely to adhere to their assigned treatment. Also, masked subjects are less likely to drop out of the study entirely when they are unaware to which group they belong. There also was no follow-up period after the training protocol was complete. This may not have necessarily been warranted being that the intervention was related to the outcome. However, having a follow-up period after the treatment intervention could have further supported the relationship between balance training and fall reduction. There also was no specific assessor identified throughout the study. It is unclear if trained clinicians versus untrained assessors were involved during the training protocol or when measuring outcomes. It is also interesting how the residents in the second nursing home were not randomly allocated into a control or intervention group but were automatically considered an intervention group.  |
| **Interpretation of Results**[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference. You may calculate effect size or confidence intervals yourself from the data provided in the article.] Describe in your own words what the results mean. |
| * The study shows that task-specific activities related to common activities of daily living improved balance thus reducing fall risk.
* Clinical significance related to the study suggests that older adults who have risk for falls can have improved balance, gait, and postural stability when emphasizing functional mobility. The authors found that this relationship was also statistically significant
* The Sensory organization test and the other four functional balance tests all resulted in statistically significant differences of improvement pre and post treatment (p<0.02). However, the control group had no statistically significant differences pre and post treatment. This further validates the conclusion that implementing a training protocol that focuses on functional balance improves balance and reduces the risk of falls.
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**(3) Description and appraisal of Fall and Injury Prevention in Older People Living in Residential Care Facilities by Jensen et al. (2002)**

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| **Aim/Objective of the Study/Systematic Review:** |
| To determine if a multi-factorial intervention program will reduce falls and injuries related to falls for older individuals living in residential care facilities who pose as a high fall risk.  |
| **Study Design**[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]Note: For systematic review, use headings ‘search strategy’, ‘selection criteria’, ‘methods’ etc. For qualitative studies, identify data collection/analyses methods. |
| * A cluster-randomized trial was conducted initially recruiting 439 residents from 9 residential care facilities in Umea, Sweden. The residential facilities were divided into Group A and Group B based on the age & number of residents, type of setting, and record of previous falls.
* Group A was essentially 4 residential facilities that consisted of 224 residents (29-74 residents per facility) with a median age from 82-85 years old. Group B was the remaining 5 facilities with 215 residents (31-66 residents per facility) with a median age from 79-85 years old.
* The physical therapists, occupational therapists, registered nurses, and physicians were not allowed to work in both groups in an effort to reduce bias
* After the baseline assessment of all of the residents was conducted, the two groups were randomly assigned by lots an intervention or control group.
* Random allocation was conducted by a blinded assessor with no knowledge of the study using two sealed dark envelopes that contained a letter specifying one of the groups. The local authorities, residents, staff of each facility, and the research group were informed of the results of the randomization.
* All of the residents gave informed consent to participate in the study and received written and oral information.
* A detailed baseline assessment of all of the participants and involved the physical therapist who interviewed and assessed the residents for fall risks, a registered nurse who reported episodes of delirium, and the resident’s physician who completed a questionnaire about their prescribed drugs and clinical characteristics and rated the residents into high fall risk or low fall risk.
* Outcome measures were reported by the registered nurses and nurses aides during the 34 week follow-up period
* Statistical Analysis
	+ Baseline factors for MMSE (mini mental state exam), Barthel Index, physical restraints and delirium, sex and history of falls, and age were all adjusted baseline factors. Adjustment for clustering was also made.
	+ The logistic regression analysis was used to determine odds rations and adjustment for clustering (Jensen et al. 2002, p. 738)
	+ Incidence rates were also set a 95% confidence intervals
 |
| **Setting**[e.g., locations such as hospital, community; rural; metropolitan; country] |
| The study was done throughout 9 residential care facilities in Umeå, northern Sweden. The residents lived in either a private apartment or a private room however, they had a communal dining and living room There was also 24-hour assistance with mobility, household issues and medical care as needed from the staff. The authors did not state if the intervention program took place in the individual homes or in the communal areas. |
| **Participants**[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article. |
| * 439 residents from 9 residential care facilities who met the criteria of having at least 25 residents were selected for the study via a cross-sectional manner.
* The residents lived in either private rooms or apartments and had communal dining and living rooms. The residents were provided with 24 hour assistance with activities as needed, household issues, or medical care.
* 37 residents were unable to participate therefore, 402 residents were assessed at baseline and randomly allocated into a control group (n=208) and intervention group (n=194)
* The baseline assessment prior to random allocation revealed that the median age was 83 years old ranging from 65-100 years of age. The majority (72%) of the participants were female, 46.5% posed as a high fall risk, 14% of the residents could ambulate without an assistive device or shower independently (18%). Only 19% were non-ambulatory and 8% were unable to feed themselves. The residents were also
* Essentially, 194 residents from 4 facilities (Group A) formed the intervention group and 208 residents from 5 facilities (Group B) formed the control group
	+ 6 residents were removed from the intervention group (3 died; 3 moved) and 12 residents were removed from the control group (8 died; 4 moved) during the 11 week intervention period.
	+ 188 residents from the intervention group and 196 residents from the control group were available after the 11 week intervention and at the start of the evaluation period/34 week follow-up. However, during the follow-up period 31 residents were removed from the intervention group (n=167) and 29 residents were removed from the control group (n=157)
 |
| **Intervention Investigated**[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided] |
| *Control* |
| The participants in the control group received “usual care” meaning the residents continued their normal daily activities as they did prior to the study with the exception of having to report their falls during the intervention and follow-up periods.  |
| *Experimental* |
| The intervention group underwent a multi-factorial program for 11 weeks. The program consisted of: Staff education, environmental modifications, Exercise, supply or repair of aids, medication modification, hip protectors, post-fall problem solving conferences, and staff guidance. Exercise: Resident specific exercises of moderate-high intensity were done2-3 times per week. 80 residents were recommended to do supervised exercises with the physical therapists. Only 70 residents were compliant with the exercises for a mean period of 9.1±2.5 weeksStaff education: The staff received a 4 hour education session led by physicians and physical therapists that addressed fall risk factors and intervention strategiesEnvironmental Modification: The physical therapists involved in the study and other staff members modified the residents’ facilities to reduce environmental hazards i.e removed throw-rugs, improved lighting, furniture changesSupply of Repair Aids: The physical therapists assessed aids used by the residents and repaired/supplied mobility related aids to 29 residentsChange in Medication: Dosage adjustments were made for 21 residents who were taking benzodiazepines (n=8), anti-depressants (n=8), neuroleptics (n=2), eye drops for glaucoma (n=2), dopamine (n=1), and diuretics (n=1) because these drugs are believed to increased the risk of fallingHip Protectors: 47 residents were offered to wear hip protectors however 34 agreed to use them during the 11 week intervention period.Post-Fall Problem Solving Conferences: After a fall occurred in the facility, the registered nurse followed up immediately (same day) and the physical therapist followed up within 3 days of the fall. The fall team that consisted of a physician, registered nurse, physical therapist, and other staff members met weekly to discuss the cause for any falls and address possible prevention. Staff Guidance: A dialogue was created among the staff and study researchers to address potential improvements for safety and fall prevention some of which were to improve transfer techniques and provide bed alarms in the rooms.  |
| **Outcome Measures** (Primary and Secondary)[Give details of each measure, maximum possible score and range for each measure, administered by whom, where] |
| The primary outcomes were the total number of residents who fell, the overall number of falls, and time amount of time it took for the first fall to occur. The secondary outcome was the amount of injurious falls. Witnessed and un-witnessed falls were documented by the registered nurses and certified nurses aides on a structured report form that was designed specifically for the study and recorded at the start of the 34 week observational follow-up period.  |
| **Main Findings**[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided – if you need to calculate these data yourself, put calculations here and add interpretation later, under ‘critical appraisal’ on next page] |
| * The number of residents who fell were significantly reduced than the control. Number of residents who fell: Overall, 384 residents fell during the study. Residents in the intervention group had less falls (82 of 188) compared to the control group (109 of 196). That is 44% and 56% respectively with a risk ration of 0.78 (CI, 0.64 to 0.96)
* When comparing the intervention group to the control group, the odds ratio for falling (using logistic regression analysis) was 0.62 (CI, 0.42 to 0.91) unadjusted for baseline factors and 0.49 (CI, 0.37 to 0.65) adjusted for baseline factors.
* 26% of the residents in the intervention group (48 of 188 residents) had >1 fall compared to 33% of the residents in the control group (64 of 196). [OR 0.71; CI 0.37-1.34] unadjusted baseline factors; [OR 0.58, CI 0.38-0.89] adjusted baseline factors
* A total of 619 falls occurred during the observation period. 273 falls happened in the intervention group compared to 346 falls in the control group during the observation days with an incidence ratio of 0.75 (CI 0.51-1.10) unadjusted for baseline factors and 0.60 (CI 0.50-0.73)-Calculated using a Poisson regression
* It took a longer time for the first fall to occur in the intervention group [unadjusted hazard ratio 0.71, CI 0.54-0.94] than the control group [unadjusted hazard ratio 0.66, CI 0.54-0.79]
* There were 101 residents in the intervention group and 106 residents in the control group at lower risk for falls. There were 87 and 90 residents at a higher risk of falls respectively. Adjusted Hazard rations were as follows: high fall risk intervention group 1.94 (CI, 1.15-3.30); high fall risk control group 2.87 (CI 1.93-4.27) referenced to the low fall risk control group of 1.73 (CI, 1.17-2.55) which showed similar differences. (Jensen et al, 2002, p. 739)
* 23% (145 out of 619) falls resulted in injuries. Injury severity was not statistically significant between groups however, 1.6% (3/188) residents in the intervention group had a femoral fracture compared to 6.1% (12/196) in the control group
 |
| **Original Authors’ Conclusions**[Paraphrase as required. If providing a direct quote, add page number] |
| The authors of the study concluded that implementing a multi-factorial fall prevention program for older adults in residential homes significantly reduced the risk of overall falls, injurious falls, and recurrent falls especially for those who were considered at high risk of falling in comparison to the control group. The authors found their results to be clinically and statistically significant in that the residents, regardless of being either a high or low fall risk, benefited similarly to the intervention. |
| **Critical Appraisal** |
| **Validity**[Methodology, rigour, selection, sources of bias, quality score on methodology quality rating scale (indicate the quality assessment tool used and the maximum possible score on that scale, e.g., 7/10 on PEDro scale), appropriateness of analytical approach (e.g., adjustments for confounding variables, management of missing data).]Comment on missing information in original paper. |
| The PEDro scale was used as the quality assessment tool for this study scoring a 6/10. The study did not blind the subjects who lived in the residential homes together, the therapists or the assessors involved in the study. Additionally, the results of the randomization were revealed to the residents, staff of the nine facilities, and the research group. It is understandable that blinding may have been difficult being that several staff members worked in more than one of the facilities however, this could lead to assessor bias and bias from the participants.An intention to treat analysis was not done for those residents who were not compliant with the protocol. A total of 18 out of 402 residents from the control group and intervention group either died or moved during the 11-week intervention period; 60 out of 384 residents from the control and intervention groups either died or moved during the 34-week follow-up period. Perhaps the authors did not find the difference to be significant enough. However, the study began with 402 residents and had a total of 324 residents from both groups by the end of the study. This threats the validity due to the tampering of the sample size and preservation of the randomized allocation of residents. Additionally, the author failed to provide details in regards to the intervention program especially with the exercise program. Only those residents who posed as either a high or low fall risk were provided a supervised exercise program however, it is unclear the frequency, duration, and amount of resistance each participant received. The eligibility criteria was not very specific even though it was defined in the study leading one to believe the authors relied mostly on the convenience of location of the participants versus having specific criteria. Fortunately there was no statistically significant difference between the control and intervention groupAlso consider the extended follow-up time (34 weeks) after the intervention. The authors did not mention if any of the residents or staff continued the treatment protocol after the intervention period. Lastly, consider the bias of several different staff members required to report falls in each resident’s chart. The authors stated they discovered 5% of the falls had not been documented properly in the chart. There also may have been instances when the falls were not documented at all.  |
| **Interpretation of Results**[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference. You may calculate effect size or confidence intervals yourself from the data provided in the article.] Describe in your own words what the results mean. |
| * The study supports that having an interdisciplinary, multi-factorial fall prevention program was superior to not having no intervention at all.
* The clinical significance related to this study suggests that a fall prevention program for institutionalized older adults should not be one-dimensional i.e. exercise only and should include other factors such as hip protectors, environmental changes and medication modifications despite being a low or high fall risk. This also reduces the risk of injurious falls and the time it took for the first fall to occur post-intervention.
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**IMPLICATIONS FOR PRACTICE and FUTURE RESEARCH**

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| **IMPLICATIONS FOR PRACTICE**Previous literature shows both positive and negative results regarding fall prevention for institutionalized older adults.1-9 The evidence reviewed in this appraisal supports the incorporation of exercise and functional balance activities as more effective than no exercise or activity training in reducing the risk of falls in institutionalized individuals. Multifactorial programs that had favourable statistically significant effects were comprehensive structured assessments with specific safety recommendations, multidisciplinary program including general strategies tailored to the setting and strategies tailored too the residents (environmental and personal safety assessments and improvements), a multifaceted intervention (education, environmental adaptation, balance training, and hip protectors), and multifactorial interventions (fall risk evaluation, specific and general interventions). Independently of the level of nursing care, it is known that because of their functional, cognitive, and physical characteristics, long term care residents are considered as very poor candidates to perform physical exercise and, therefore, most of the exercise programs to prevent falls and fractures have focused on older persons living in the community. With the most recent reports suggesting that exercise is ineffective in long term care facilities6, this intervention has been abandoned in multiple institutions worldwide. Indeed, this review contradicts that evidence by demonstrating that exercise is still effective in this particular setting. When exercise is included as part of a multifactorial intervention, the guidelines are similar to those for community-dwelling older adults. Shubert et al5 suggest the following: “the intervention should focus primarily on balance and balance challenge exercises, the exercises should be done while standing, and should be progressed over a period of time. Exercise interventions to improve balance and strength have been demonstrated as feasible and safe in both frail older adults and those with significant cognitive impairment.”Also, a particularly interesting finding was that exercise programs were effective in preventing falls if performed for at least11-12 weeks. The findings of this study could be used by health professionals to develop strategies to design effective protocols of physical exercise in long term care facilities by adequately considering the time and frequency of the exercise that are more effective on reducing falls. **FUTURE RESEARCH**One of the questions that remained unexplored in the literature was whether combined exercise programs are more effective than single exercise to improve multiple physical components such as strength, endurance, balance, flexibility, gait, and mobility and thus, prevent falls. The evidence obtained from community settings suggests that single exercises, mostly balance exercise, reduce fall rates in community dwelling older populations.7Neyens et al. recommend that health care professionals who wish to reduce fall incidents in long-term care facilities develop interventions specifically tailored to their long-term care setting and residents.7 Perhaps, it would be beneficial if tailor-made intervention programs were tested ona small scale initially to assess their implementation aspects for a particularsetting and to improve program weaknesses.7Because cost-effectiveness is not addressed in the reviewed studies and in many of the related literature, Quigley et al suggest the following in regards to cost effectiveness8:1. Cost effectiveness of sustainability for organization-, staff-, and patient-level interventions;2. Effectiveness of population-specific intervention studies, i.e. residents with dementia, residents with recurrent falls, residents with known history of injurious falls;3. Cost-effectiveness trials to determine the optimal dose, intensity, and depth of injury prevention interventions: hip protectors, floor mats, height adjustable beds, plus falls clinical nurse specialist; use of unit-based fall champions, use of clinical interdisciplinary falls team;4. Cost-effectiveness of falls consult teams versus dedicated program staff on falls, recurrent falls, injurious falls, and staff/patient behaviors; and5. Effectiveness of injury protection (injury risk assessment, post fall injury evaluation and treatment) versus standard of care fall prevention programs. |

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[List all references cited in the CAT]

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