

Supplementary File D: ICA Codebook – Fall prevention exercise in residential aged care

1. THEME 1: RIGHT EXERCISE

Subtheme 1: STRENGTH AND BALANCE 11 trials, 21 codes

1. Arrieta: Our participants, had high adherence to the multicomponent strength and balance exercise sessions, which proved to be well tolerated by those with lower physical function and enhanced their capacity to perform daily activities and avoid falls.
2. Arrieta: Individualised strength and balance moderate intensity exercise is safe for residents in nursing homes.
3. Arrieta: Multicomponent (strength and balance) interventions appear to be most effective for improving the overall physical status of older adults and preventing disability and other adverse outcomes.
4. Arrieta: Strength and balance program observed significant improvement in intervention and a marked decline in control in all assessed parameters.
5. Dhargave: Multicomponent exercise program focusing primarily on strength and balance training was the most effective strategy in managing falls in the elderly.
6. Dhargave: Strength and balance training in the elderly is successful in reducing episodes of falls.
7. Dhargave: Stronger muscles around the ankle are important for recovery of balance and near normal range of motion seems to be necessary for utilising better balance strategies and maintaining steady posture
8. Hewitt: Moderate intensity progressive resistance training and high level balance exercise can significantly reduce falls and improve physical performance in residents of long-term aged care facilities.
9. Kerse: Our study did not use a focused approach to intensively work on underlying impairments such as muscle weakness or balance problems.
10. Kerse: Residents with poor cognition did not benefit from functional training. Further refinement in potential interventions is needed for those with poor cognition.
11. Irez: Three months of Pilates exercise resulted in a decrease in the number of falls and an improvement in balance.

12. Irez: By performing designated strength and balance Pilates exercises within training program, improvements were seen amongst all dependent variables, including falls.
13. Jahanpeyma: Otago's strength and balance program saw a reduction in falls compared to control.
14. Jahanpeyma: Walking program alone may be insufficient to reduce the number of falls.
15. Jahanpeyma: Walking program supplemented with Otago strength and balance exercises strengthens lower extremities, thereby preventing falls.
16. Jahanpeyma: The Otago exercise program seems to improve balance and physical performance in older adults and thus may be an effective intervention for reducing and preventing falls in nursing home residents at high risk of falling.
17. Mulrow: Physiotherapy interventions that focus on strength and mobility have more value than range or motion exercises for many residents.
18. Rosendahl: In sub-group analysis, those who reduced falls benefitted from targeting balance and functional strength exercises such as sit to stand.
19. Sitja Rabert: Whole body vibration, together with a strength and balance exercise program, is a safe intervention, and its benefits in body balance, gait, functional mobility, and muscle strength are similar to those of strength and balance exercise alone in institutionalized elderly individuals.
20. Toots: High intensity strength and balance functional exercise improved balance in older persons with dementia living in residential care facilities but did not reduce falls.
21. Yokoi: Positive fall prevention effects were seen, as well as improvement in balance reaction and functional strength.

Subtheme 2: TAILORED EXERCISE 12 trials, 34 codes

1. Arrieta: Adherence to fall prevention programs could be influenced by residents with low physical function or severe cognitive deficit.
2. Arrieta: Important to account for differences in functional status to facilitate creating an optimal exercise program for older people
3. Arrieta: Previous trials have not considered the heterogeneity of physical function and personal skills to achieve optimal stimulus.
4. Arrieta: There were few significant intervention effects in participants with better mobility baseline scores on the SPPB. The lower efficacy of the program in participants with better functional status might be due to the insufficient exercise demands of this program for higher functioning older adults.
5. Dhargave: A well-designed tailored exercise program is advisable for elderly individuals to improve their gait and balance function and thus may reduce the episodes of falls and the risk of falls.
6. Dhargave: Residential aged care needs early admission to tailored exercise program for elderly to maintain balance and gait and prevent deterioration, which can predispose to falls.
7. Dhargave: Tailored exercise program was found to reduce falls and improvement in balance confidence and obstacle clearance.
8. Dhargave: This trial was designed by experienced nursing home physiotherapists and was targeted to the individuals' particular deficits.
9. Dhargave: Overall results showed that this particular Physical Therapy program aimed at very frail long-stay nursing home residents with disability due to multiple conditions led to modest improvements in mobility.
10. Dhargave: The results should not be generalised to less frail, long-stay residents.
11. Faber: Broad inclusion criteria resulted in a sample with a wide range of medical conditions, and functional limitations might explain the lack of significant reduction in falls
12. Faber: Exercise prescription must ensure interventions are challenging yet safe - more difficult in more frail groups.

13. Faber: Frail participants did not always succeed in performing exercises in the intended standing position and resorted to sitting position due to fatigue.
14. Faber: Functional walking and balance increased risk to becoming faller is significant in frail elderly without any sig changes to physical performance.
15. Fu: Tailoring different training modes and environments may been associated with significantly better performance in Wii Fit balance training than control.
16. Hewitt: Tailored strength and balance exercise program reduces falls
17. Kerse: This negative result highlights the importance of the specificity of training
18. Kerse: Low intensity functional training based on activities of daily living did not help to preserve physical function in frail elderly people with normal cognition in residential care and may have adversely affected those with poor cognition
19. Kovacs: Tailoring fall prevention exercise programs to those with physical abilities such as strength, balance and gait
20. Mulrow: These results, as well as others, suggest that strength and mobility deficits are common among nursing home residents, and interventions that focus on these deficits may be most beneficial
21. Nowalk: Fall prevention programs need to be tailored to suit individual seniors' changing needs, interests, physical, and cognitive capabilities.
22. Nowalk: Tai chi is not possible over a long intervention period due to the learning demands of cognitively impaired people.
23. Rosendahl: Fall prevention exercise is more likely to be successful if tailored to a broad spectrum of predisposing factors in older people.
24. Rosendahl: Previous successful fall prevention programs exclude people with dementia and poor balance.
25. Rosendahl: High intensity exercise may need to be included as part of a multifactorial fall prevention interventions due to comorbidities
26. Rosendahl: It seems important to investigate further what characterises people who are likely to respond to fall prevention exercise.

27. Sitja Rabert: Another factor that could influence the negative results in our study is the higher comorbidity and greater limitations in participants' autonomy.
28. Sitja Rabert: Another justification for the no difference in falls is that our intervention group included participants with higher cognitive impairment and a history of falls.
29. Toots: The results of this study support the notion that dementia should not be considered a single disease entity but rather constitutes separate disorders with clinical symptoms that may require different strategies to optimize symptom management.
30. Toots: Improvement in balance and attenuation of decline in ADL independence were exclusive to patients with non-Alzheimer's dementia.
31. Toots: Larger effect of exercise on balance seen in patients with higher cognitive function reinforces the potential moderating effect of cognitive function on fall prevention programs.
32. Toots: Different balance response between different types of dementia to high intensity functional fall prevention exercise programs
33. Toots: Physical function and clinical symptoms typical of certain dementia types may influence response to an exercise program
34. Toots: Dependence in ADLs is multifactorial, with various compositions and causes that may not be equally predisposed to change.

Subtheme 3: MODERATE INTENSITY 8 trials 21 codes

1. Arrieta: The primary finding in this study was that six months of individualized and progressive multicomponent exercise at moderate intensity composed of strength, balance, and walking recommendations in long-term nursing homes (LTNH) residents was effective in preventing falls and reducing frailty and mortality.
2. Arrieta: Individualised strength and balance moderate intensity exercise is safe for residents in LTNH.
3. Arrieta: Multicomponent exercise interventions at moderate intensity could be efficient for improving gait, balance, strength and reducing frailty in older adults in LTNH, which aligns with previous results in other studies.
4. Arrieta: Attendance at moderate intensity exercise sessions in our study was higher (91%) than that found in similar studies that tested low intensity exercise.
5. Dhargave: Moderate to high intensity strengthening and endurance exercise program for 12 weeks will significantly improve the gait and balance in elderly.
6. Dhargave: The individuals enjoyed participating in the moderate intensity exercise program and didn't complain about any untoward incidents.
7. Faber: Absence of a significant reduction in falls could be attributed to the inadequacy of intensity, frequency, duration and/or specificity of exercise mode.
8. Faber: Frail elderly may need individual and more vigorous training approaches to reduce falls.
9. Faber: High-intensity individual training would make the program unsuitable for long-term incorporation into daily life.
10. Faber: Moderate intensity group exercise is preferred amongst the elderly as an opportunity to socialise is key element in sustaining participation.
11. Hewitt: This trial achieved a 55% fall rate reduction, a greater reduction than for any previous intervention in a residential aged care setting, potentially because it is the first to implement the published key components (strength and balance, moderate intensity) and dosage of successful falls prevention exercise programs.
12. Hewitt: Moderate-intensity progressive resistance training and high-level balance exercise can significantly reduce falls and improve physical performance in residents of long-term aged care facilities.

13. Hewitt: Outcomes differ from previous research that employed the use of seated, range of motion, light resistance or simple walking programs.
14. Hewitt: The intensity of the PRT in this trial that is 2 to 3 sets of 10 to 15 repetitions for each exercise at a perceived intensity of "moderate" using the Borg Scale of Perceived Exertion, also differs from prior research that advocated more intense training.
15. Kerse: Either a more intensive intervention or more effort in implementation would be needed to achieve functional improvement in this population.
16. Kerse: To be successful, fall prevention interventions may need a higher intensity of activity than low intensity exercise.
17. Rosendahl: Among older people living in residential care facilities, a high-intensity functional exercise program did not significantly reduce either the fall rate or proportion of participants who sustained a fall overall, compared with a control activity.
18. Sitja Rabert: Low intensity exercise on high physical functioning people in aged care is not effective.
19. Toots: High intensity exercise did not reduce falls in people with dementia in nursing homes.
20. Toots: Strength exercises were performed at moderate to high intensity levels.
21. Toots: High dose of exercise may be more important than exercise intensity for greater effects on falls

THEME 2: SUPPORTING EXERCISE ENGAGEMENT

Subtheme 1: SUFFICIENTLY RESOURCED 8 trials 17 codes

1. Arrieta: Routine multicomponent exercise intervention composed of resistance, balance, and gait exercises should be included for institutionalised older adults, as it seems to be effective for improving overall physical outcomes and preventing disability and other outcomes in this population.
2. Dhargave: The study identified an overall reduction in the risk of falls in individuals who underwent structured exercise programs, whereas we identified that those who were not provided with any of the supervised training had an increase in the risk of falls after the study period.
3. Dhargave: Strength and flexibility training needs to be part of a structured exercise program for elderly individuals.
4. Dhargave: Our study contributed to this gap by identifying the effect of structured exercise programs on elderly individuals staying at various geriatric homes in India.
5. Dhargave: Further studies consisting of a structured institutional-based supervised exercise program with equipment-assisted assessment protocols will give a better picture of the current study.
6. Hewitt: Increase in engagement due to resident wanting to spend time with specialised strength exercise equipment
7. Hewitt: Sunbeam findings suggest exercise dose of 30 or more hours produce outcomes similar to those with higher doses (e.g., 50 hours) previously recommended.
8. Hewitt: Reduced physiotherapy input reduced exercise engagement.
9. Irez: Buying balance and strengthening exercise equipment has a more significant impact on reducing falls.
10. Kerse: More effective reinforcement by care workers is required to reduce falls.
11. Kovacs: 12 monthly physio-led exercise programs provide better outcomes than six months.
12. Kovacs: Physiotherapy is more expensive to provide to frailer cohorts to improve mobility but needed.
13. Mulrow: Because it was based on standardised assessments and prioritized treatment plans, the therapy program was probably more consistent than what is generally practiced.

14. Mulrow: Funding sufficient physiotherapy delivers modest improvements in mobility amongst very frail nursing home residents with a disability.
15. Toots: Structured exercise programs are required to reduce falls regarding exercise mode, intensity and frequency.
16. Toots: The application of better balance to reduce the level of assistance required in ADLs relies on the responsiveness of care staff, and routines and time constraints may limit it.
17. Toots: The use of a structured exercise program improves the potential to replicate the results of this study clinically or for research purposes.

Subtheme 2: GROUP EXERCISE ALLOWING FOR SOCIALISATION 3 trials six codes

1. Faber: Another reason for preferring moderate intensity programs is that a key element in sustaining exercise participation of older people is the opportunity to socialise.
2. Faber: Moderate intensity group exercise is preferred amongst the elderly as an opportunity to socialise is a key element in sustaining participation.
3. Faber: Group exercise is feasible in frail nursing home residents.
4. Hewitt: Increase in attendance may be related to patients choosing to spend time attending classes in a known format using both gym equipment and physiotherapy involvement.
5. Sitja Rabert: Group exercise program was appropriate and enjoyable as compliance was more than 75%.
6. Sitja Rabert: Group exercise is a safe intervention.

Subtheme 3: STAFF AND RESIDENT EDUCATION 4 trials six codes

1. Fu: Real-time visual feedback to the participants would be expected to improve the training process as compared with conventional training.
2. Fu: Performance feedback as to the status and outcome of a response is generally accepted to be necessary for most forms of learning or skill acquisition, including the learning process that underlies rehabilitation.
3. Fu: Presentation of cuing stimuli that could be used for “error-free” learning approaches in rehabilitation scenarios.
4. Hewitt: Educating staff and residents on the potential benefits of progressive resistance training and balance training may have resulted in higher participation rates.
5. Kerse: The importance of specificity of training. The training approach in this study focused on practicing overall functional tasks embedded within daily activities facilitated by existing staff.
6. Nowalk: This program included an intensive team management approach to reducing falls through staff training, regular quality improvement meetings, enhanced basic programs for residents, and two exercise interventions.

TRIALIST'S METHODOLOGICAL COMMENTARY

SMALL SAMPLE SIZE 7 trials seven codes

1. Arrieta: In addition, the study length and sample size are one of the largest among studies focused on multicomponent exercise programs in LTNH.
2. Faber: Lack of a significant reduction in falls due to a study being underpowered.
3. Irez: Results showed no differences in described variables. This may be related to the small number of participants. In our study, the sample size was much larger than in the previously mentioned study.
4. Nowalk: A limitation of this study is the sample size.
5. Rosendahl: However, more participants or a longer follow-up period would certainly have been preferable in evaluating falls.
6. Sitja-Rabert: The main limitation of this study is that it did not have sufficient power to clinically detect relevant results in fall prevention.
7. Toots: Small sample size limited statistical power.

CONTROL GROUP NEEDS TO HAVE NO ACTIVE EXERCISE 5 trials six codes

1. Irez: Our study involved a control group of no active exercise, whilst alternate studies that were ineffective did not.
2. Jahanpeyma: Using active exercise in the control group reduces research outcomes.
3. Kovacs: Future research needs to ensure different types of exercise are compared to an inactive control group to better understand the most effective fall prevention exercise intervention.
4. Rosendahl: Physical activity in the control group could have explained non-significant fall outcomes between groups.
5. Sitja-Rabert: No difference between groups, could have been a result of the inclusion of active exercise in the control group.
6. Sitja-Rabert: One factor that could explain the differences in results in this study is the similar exercises in the control group.