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| **CRITICALLY APPRAISED TOPIC** |

**FOCUSED CLINICAL QUESTION**

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| In an elderly individual who is at risk for falls, will a seated strengthening home exercise program reduce risk of falls? |

**AUTHOR**

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**CLINICAL SCENARIO**

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| An elderly patient expressed a goal to ambulate to the community dining room without her assistive device. She was at risk for falls as determined by her initial assessment and initial functional outcome measures on the TUG so ambulation without an assistive device was not an immediate possibility. Since she lived alone, she needed a safe, simple and effective home exercise program (HEP) to help achieve her goal of independent ambulation without an assistive device. In order to assure compliance with the current plan of care as well as work towards a safe level of function, an objective means of measuring progress was necessary. I wanted to honor her request to be free from the social stigma of a cane, but I also needed her and her caregivers to respect my professional judgement. So, together we determined that if the patient consistently performed her HEP and scored a certain level in her balance outcome measures, then we would be reasonably assured of her safety and she would be ready to ambulate to the dining room without her cane. Due to her limited mobility and due to safety concerns, we chose to use a seated LE strengthening program. Finding a safe, yet effective HEP for falls risk patients in home care can be challenging but the HEP is critical to the success of the intervention. Knowledge about a safe and effective HEP that demonstrates a clinically objective improvement in balance and falls risk reduction will enable the clinician to meet balance and ambulation goals safely and effectively. |

**SUMMARY OF SEARCH**

[Best evidence appraised and key findings]

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| * 3 databases, PubMed, CINAHL and Cochrane database were searched. 10 articles were identified and reviewed: 6 randomized controlled trials, 2 systematic reviews, 1 cluster-random design and 1 cohort study. * Evidence from the most relevant, highest quality studies reveal: * Frail elderly can make significant gains in strength in response to a progressive strengthening exercise program. * Strength gains in the frail elderly may contribute to improved outcomes such as improved quality of life, gait and transfers, however, there appears to be no improvement in measures of balance. * A home exercise program for the frail elderly is appropriate, safe and most effective when performed under professional supervision. * Most home exercise programs that address balance outcomes include seated as well as standing interventions |
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**CLINICAL BOTTOM LINE**

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| * These studies suggest that frail elderly enrolled in studies demonstrate both the willingness and the potential to follow a structured progressive strengthening exercise program under medical supervision. In addition, safe, strengthening interventions exist that promote clinically significant strength changes in the frail elderly. There is little information, however that an exclusively seated home exercise program is effective or is beneficial in producing improvement in standing balance outcomes. The results of this search demonstrate that interventions in addition to progressive resisted exercises may lead to clinically meaningful changes in measures of balance. Therefore, the clinician who wants to make balance changes with the frail elderly should investigate added interventions that can be safely followed as a home exercise program. Seated strength training alone is not sufficient to create a significant impact on balance measures in the frail elderly. |

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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*** |

**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  Elderly  Aging  Geriatric  Fall | Exercise  Train  Strengthening  Physical therapy  Rehabilitation  Physiotherapy  Home exercise  Home program  Seated  Sitting  Balance | No comparison | TUG score  “timed up and go”  Walk\*  Gait  Ambul\* |

**Final search strategy:**

1. elderly OR older adult OR geriatric OR age\* 4237176

2. fall OR falls risk 147383

3. physical therapy OR rehabilitation OR physiotherapy 574454

4. Balance 187226

5. Exercise OR exercis\* 326073

6. Home exercise OR home care 715730

7. Seat\* OR sit\* 1332727

8. Ambul\* OR gait 61138

#1, #2, #3, #4, #5, #6, #7, #8 Yield 8 results. Sit\* too many hits > 600; ambul\* too many hits

#1, #2, #3, #4, #5, #6, #8 yield 160 results

9. Seated 8592

10. Ambulation 64415

#1, #2, #3, #4, #5, #6, #9, #10 yield 1 result

#1, #2, #3, #4, #5, #6, #9 yield 4 results

#1, #2, #3, #4, #5, #6 yield=232 results

11. Fall OR fall risk

#1, #2, #3, #4, #5, #6, #11 yield= 130 results

Removed the 5 year limits from search. Chose 46 abstracts to review.

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| **Databases and Sites Searched** | **Number of results** | **Limits applied, revised number of results (if applicable)** |
| **PubMed**  **1. Elderly OR older adult OR geriatric OR age\***  **2. Fall OR falls risk**  **3. Physical therapy OR rehabilitation OR physiotherapy**  **4. Balance**  **5. Exercise OR exercis\***  **6. Home exercise OR home care**  **7. Seat\* OR sit\***  **8. Ambul\* OR gait**  **#1, #2, #3, #4, #5, #6, #7, #8 Yield 8 results. Sit\* too many hits > 600; ambul\* too many hits**  **#1, #2, #3, #4, #5, #6, #8**  **9. Seated**  **10. Ambulation**  **#1, #2, #3, #4, #5, #6, #9, #10**  **#1, #2, #3, #4, #5, #6, #9**  **#1, #2, #3, #4, #5, #6**  **11. Fall OR fall risk**  **#1, #2, #3, #4, #5, #6, #11**  **Chose 46 abstracts to review.**  **CINAHL**  **#1. elderly OR older adult OR geriatric OR age\***  **#2. fall OR falls risk**  **#3. physical therapy OR rehabilitation OR physiotherapy**  **#4. Balance**  **#5. Exercise OR exercis\***  **#6. Home exercise OR home care**  **#7. Seat\* OR sit\***  **#8. Ambul\* OR gait**  **#1, #2, #3, #4, #5, #6, #7, #8**  **#9. Seated**  **#1, #2, #3, #4, #5, #6, #8, #9**  **#10. Ambulation**  **#1, #2, #3, #4, #5, #6, #8, #10**  **#1, #2, #3, #4, #5, #6**  **Cochrane Database**  **#1 elderly OR older adult OR geriatric OR age\***  **#2. fall OR falls risk**  **#3. physical therapy OR rehabilitation OR physiotherapy**  **#4. Balance**  **#5. Exercise OR exercis\***  **#6. Home exercise OR home care**  **#7. Seat\* OR sit\***  **#8. Ambul\* OR gait**  **#1, #2, #3, #4, #5, #6, #7, #8** | **4237176**  **147383**  **574454**  **187226**  **326073**  **715730**  **1332727**  **61138**  **160**  **8592**  **64415**  **1**  **4**  **232**  **130**  **46**  **521,354**  **5,185**  **23,425**  **7,181**  **19,282**  **8,659**  **19,933**  **13,348**  **4**  **331**  **0**  **3,514**  **1**  **28**  **391850**  **10502**  **57316**  **12203**  **52198**  **13763**  **59887**  **21581**  **37** | **English, human, publication dates since 2009, “elderly older than 60 years old”.**  **#1, #2, #3, #4, #5, #6, #7, #8 Yield 8 results. Sit\* too many hits > 600; ambul\* too many hits**  **Removed the 5 year limits from search.** |

## INCLUSION and EXCLUSION CRITERIA

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| **Inclusion Criteria** |
| RCT’s, controlled trials, uncontrolled trials  Published up to August 2015  A protocol that includes a physical therapy intervention  Population of adults over 60 years old  Uses a home exercise program  Measures balance and/or fall risk with TUG  Published in English |
| **Exclusion Criteria** |
| Studies that involved adults with cognitive impairments, neurological or cardiopulmonary diagnoses or unhealed/unstable orthopaedic conditions  Case studies or case series  Abstracts, conference proceedings, letters to the editor, dissertations, narrative review articles |

**RESULTS OF SEARCH**

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

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| **Author (Year)** | **Study quality score** | **Level of Evidence** | **Study design** |
| Latham NK, et al (2003) | PEDro  Score=9 | Level 1b | RCT |
| Chandler et al (1998) | PEDro Score=6 | Level 1b | RCT |
| Topp et al (1993) | PEDro Score=6 | Level 1b | RCT |
| Cyarto et al (2008) | PEDro Score=10 | Level 1b | Cluster random-design |
| Faber et al (2006) | PEDro Score =10 | Level 1b | RCT |
| Gillespie et al (2012) | AMSTAR =11 | Level 1a | Systematic review |
| Howe et al (2011) | AMSTAR=10 | Level 1a | Systematic review |
| Lee et al (2013) | PEDro Score=9 | Level 1b | RCT |
| Liu-Ambrose et al (2004) | PEDro Score=7 | Level 1b | RCT |
| Matsuda et al (2010) | Downs and Black Checklist= 19/31 | Level 2b | Cohort study |

**BEST EVIDENCE**

The following 3 studies were identified as the ‘best’ evidence and selected for critical appraisal. Reasons for selecting these studies were:

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| * **Latham NK, Anderson CS, Lee A, Bennett DA, Moseley A, Cameron ID; Fitness Collaborative Group. A randomized, controlled trial of quadriceps resistance exercise and vitamin D in frail older people: the Frailty Interventions Trial in Elderly Subjects (FITNESS). J Am Geriatr Soc. 2003 Mar;51(3):291-9. PEDro Score=9. So, relatively free from bias. The sample size included the frail elderly, a likely group of patients who likely require safety measures in the performance of the HEP. This is the target patient population for the PICO question. The participants were randomly assigned to one of four treatment groups and the follow-up measurements were made by a reviewer who was blind to the intervention. The equipment used in the study was inexpensive and readily available to any patient or clinician for home use. One measure of physical performance included a test of balance, the Berg Balance Score which would provide an objective measure of falls risk improvement. The exercise intervention was performed in a seated position and was designed to provide maximum strength in the elderly to a major muscle group that may affect balance. In addition, this exercise program may easily be duplicated in the clinic.** * **Chandler JM, Duncan PW, Kochersberger G, Studenski S. Is lower extremity strength gain associated with improvement in physical performance and disability in frail, community-dwelling elders? Arch Phys Med Rehabil. 1998 Jan;79(1):24-30. PEDro score=6. This is a randomized-controlled study that investigates frail elderly who are community dwellers, therefore the data may be considered for the home care population. The intervention requires low cost equipment that a home care therapist and patient can easily obtain. The authors attempted to objectify use of the resisted bands to the amount of strength the subject generated. Strengthening intervention includes multiple muscle groups responsible for function and balance. Muscle strengthening was correlated with several factors including an objective outcome measure of balance, Functional Reach, which is a focus of the clinical question. The study is an older one, published in 1998, however, study quality is high with a fair bias level and it includes seated exercises as part of its focus. Additionally, the setting and the population of frail elderly community dwellers correlate well with a home-based population that my question addresses.** * **Topp R, Mikesky A, Wigglesworth J, Holt W Jr, Edwards JE. The effect of a 12-week dynamic resistance strength training program on gait velocity and balance of older adults. Gerontologist. 1993 Aug;33(4):501-6. PEDro Score =6. The study participants included community dwelling elderly who perform an exercise intervention designed for home use. Strength changes were correlated with objective measures of balance including the modified Romberg protocol and a dynamic test of backwards walking. The equipment used is designed for home use even though one of the three weekly sessions was held in a group setting. The significance of the results of the intervention were clearly graphed by the authors and showed the correlation between the tested group and the control group for every intervention. The study included a combination of home exercises and group exercises so it addressed the clinical question of an individual home exercise program, where other studies addressed exercise performance in centers or in groups. Despite the age of the study, additional reasons for choosing this study are its strength, the design as a randomized controlled study, the inclusion of seated exercises and the population addressed.** |

**SUMMARY OF BEST EVIDENCE**

**(1) Description and appraisal of Description and appraisal of: A randomized, controlled trial of quadriceps resistance exercise and vitamin D in frail older people: the Frailty Interventions Trial in Elderly Subjects (FITNESS) by Latham NK, Anderson CS, Lee A, Bennett DA, Moseley A, Cameron ID; Fitness Collaborative Group. 2003.**

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| **Aim/Objective of the Study/Systematic Review:** |
| The objective of the study was to determine if vitamin D consumption and quadriceps exercises reduce falls and promote a healthy lifestyle in frail elderly who are recently discharged from the hospital. |
| **Study Design** |
| * A multi-center, randomized, controlled trial * A longitudinal, prospective design using a pre-test/post-test design * 2 x 2 factorial treatment group design * Subjects were recruited from five acute care and rehabilitation teaching hospitals between February 1999 and December 2000 * Research officers screened all patients admitted to geriatric units * Patients were prospectively screened and classified into independent, frail or fully dependent groups * Eligible frail patients were randomly allocated to one of four treatment groups by a computerized randomization scheme using a stratified block randomized technique * Outcome measures were obtained at baseline, 3 and 6 months from initiation of the study by nurses who were blinded to the assigned treatment groups * Blinding of the assessor was tested at the 6 month visit by asking the assessor to guess which patients received the exercise intervention * Analysis was on an intention-to-treat basis using the Kaplan-Meier survival curve * Double- blind allocation for the Vitamin D intervention * Single-blind allocation for the exercise intervention |
| **Setting** |
| * Treatment locations: Subjects received the first 2 treatments in an inpatient geriatric rehabilitation unit selected from one of five hospital centers in New Zealand. The remaining treatments were performed in each subjects’ home. |
| **Participants** |
| * 243 total subjects were recruited to the study. Resistance group N=120, Attention control N=123. Vitamin D N= 121, Placebo N=122. * Method of recruitment: was not explicitly stated, however recruitment was from one of 5 large, public metropolitan acute care and rehabilitation teaching hospitals * Inclusion criteria for subjects: aged 65 and older and considered frail using clinical measures of frailty described by Winograd et al; no clear indication or contraindication to either of the study treatments. * Random sampling of subjects: from all patients in the geriatric rehabilitation unit * Age, mean (years): 80 for the exercise group, 78 for the attention control, 79 for the vitamin D, and 80 for the placebo * Gender: female/male (%): Resistance exercise:66/34, Attention control:63/37, Vitamin D: 64/36, Placebo:80/20 * Baseline characteristics for subjects: balanced across all treatment groups at 95% CI for age, BMI, self-report measures and measures of physical performance * No subjects lost to follow-up * 14 subject deaths. Resistance exercise N=6, Attention control N=8, Vitamin D N=11, Placebo N=3 * 7 subject refusals at follow up. Resistance exercise N=2, Attention control N=5, Vitamin D N=2, Placebo N=5 * 222 subjects completed follow-up. Resistance exercise N=112, Attention control N=110, Vitamin D N=108, Placebo N=114 |
| **Intervention Investigated** |
| *Control* |
| * Exercise control subjects received phone calls and home visits 3 times per week x 10 weeks from the research physical therapist. No specific distinction between number of calls or visits was described. * Research physical therapist performed non-specific interventions with the attention control group including asking about patient recovery, providing general advice and approving appropriate recovery actions, however, no script or specific questions were described. * Vitamin D placebo subjects received a single dose of a placebo tablet at the initiation of treatment from a nurse who was blinded to the treatment. |
| *Experimental* |
| * Exercise experimental subjects performed progressive exercises to the quadriceps approaching 60-80% of 1 RM 3 times per week for 10 weeks * 1 RM was assessed at baseline using ankle cuff weights * Subjects performed the first two sessions in the hospital, then completed the program at home * Exercise session started with individualized hamstring and quadriceps stretching warm-ups. No specifics given. * Subjects performed seated resisted exercises for 3 sets of 8 repetitions using ankle cuff weights. No protocol was outlined. * Treatment re-assessment and progression was performed as appropriate by the physical therapist to achieve high intensity exercise levels * Weekly home visits by a physical therapist was alternated with phone calls to monitor exercise progress. No specific schedule was given. * Subjects used a diary to record exercise compliance and number of falls * Vitamin D experimental group received one dose of six 1.25-mg Vitamin D tablets from a nurse who was blinded to the treatment group |
| **Outcome Measures** (Primary and Secondary) |
| * Primary outcome measures: Self-related physical health (PCS FS-36) and falls. Research nurses blinded to the treatment groups gave subjects follow-up self-related measure of health at 3 and 6 months in the patients’ homes. The PCS of the SF-36 measures quality of life (HRQoL) and emphasizes physical function, role-physical, bodily pain and general health. 36 items divided into 8 subscales and 2 domains. Weighted Likert system is used for each item. 8 subscales are summed and transformed to a 0-100 scale. Each domain mean scored is 50. * Falls were recorded in a falls diary kept in the subject’s home. Subjects received weekly reminder phone calls by the physical therapist to record falls in the dairy. Details about each fall were examined by a research nurse at 3 and 6 month follow-up. * Secondary outcome measures assessed by a research nurse included Physical performance: isometric knee extensor strength, Berg Balance Test, Timed Up and Go, 4 Meter Walk Test; Mini-Mental State Examination (MMSE); and Self-reported activities: Barthel Index, Modified Falls Efficacy Scale, Adelaide Activities Profile; Level of Vitamin D; measure of pain and fatigue. * Isometric strength measured in kg with a hand-held dynamometer at 90 degrees knee flexion * Berg Balance test: a 14 item functional balance test rated from 0-4. Range 0-56. A higher score indicates better balance. * Timed Up and Go: a timed balance test requires sit to stand, 3 meter walk, turn and return to seated position. Risk of falls with scores >12 seconds * 4 Meter Walk Test: a timed test for walking 4 meters * MMSE: a 30 point measure of cognitive impairment. Range 0-30 * Barthel Index: assesses ADL function and mobility in ten areas rated between 0-15. Range 0-100 * Modified Falls Efficacy Scale: measures subjects’ confidence level on a 14-item test rated from 0-10. Range 0-140. It is a 14 activity questionnaire scored on a 10-point visual analogue scale with 0= not confident at all, 10=very confident yielding a range of scores from 0-140 points. Higher scores reflect more confidence. * Adelaide Activities Profile: a 21-question test of lifestyle activities: domestic chores (0-24), household maintenance (0-21), service to others (0-15) and social activities (0-12). * Level of Vitamin D: measured by blood serum levels * Pain: measured on a 4 point Likert scale * Fatigue: measured on a 4 point Likert scale |
| **Main Findings** |
| Outcome measures at 3 months:   * Mean score for PCS of the SF-36: Resistance exercise=34, Attention control=35. Mean difference of 1. Vitamin D=35, Placebo=35. Mean difference of 0. At 95% CI, there was no effect of exercise on quality of life * Vitamin D was effective in increasing mean levels of 25-hydroxyvitamin-D at 3 months compared to placebo, however, there was no significant effect across primary and secondary outcome measures   Primary Outcomes at 6 months: N=222   * No significant treatment differences (p<.05) for any of the variables. * Total number of falls: Resistance exercise=164, Attention control=149. Mean effect of 15. Vitamin D=157, Placebo= 156. Mean effect of 1. * Number of people who fell: Resistance exercise=60, Attention control=64, Mean effect = 4. Vitamin D=64, Placebo=60. Mean effect =4. * Relative risk of a fall at 95% CI: Resistance exercise=0.96, Vitamin D=1.14 * There was no significant effect of the resistance exercise on any of the primary outcome measures (p<0.05) * Resistance exercise group demonstrated a risk ratio of 3.6, at 95% CI for increase in musculoskeletal injuries compared to the control * Vitamin D increased mean levels of 25-hydroxyvitamin-D at 6 months, however, there was a lack of effect of vitamin D treatment across any primary outcome measure   Secondary Outcomes at 6 months at 95% CI:   * There were no significant effects of exercise or vitamin D on the secondary outcome measures of Barthel Index, Modified Falls Self-efficacy Scale, 4 domains of Adelaide Activities Profile, quadriceps strength, 4 Meter Walk Test, Timed Up and Go Test or Berg Balance Test. Between group differences were < or= to 0 |
| **Original Authors’ Conclusions** |
| The authors concluded that in a frail population, there was no significant treatment effect on improved physical health or falls reduction from either resisted exercise or administration of vitamin D in a 3 to 6 months follow-up period. They offered several explanations for the lack of treatment effect of exercise and vitamin D. While the design of the exercise program fostered increased compliance (82%) the simplicity of targeting one muscle group potentially neglected other muscles that may have contributed to improved performance. Additionally, changing the mode of exercise from seated to standing would have recruited greater functional use of the quadriceps potentially providing increased strength for falls prevention. Exercise in the home setting proved to be more injurious for the frail patient due to either high intensity or the unsupervised nature therefore, the authors recommend that frail patients be supervised while performing high intensity exercise or that progression towards high intensity exercise be gradual. Based upon their review of other studies involving vitamin D, the authors suggest adding calcium to vitamin D to enhance physical performance of future subjects. They do acknowledge the possibility of a modest effect of vitamin D on subjects with extremely low vitamin D levels.  The authors also conclude that the results of the study may be generalized to a larger population of frail elderly due to recruitment from multiple treatment centers and due to broad patient recruitment characteristics. |
| **Critical Appraisal** |
| **Validity**  [Identify the strengths and limitations of the study, including potential sources of bias. Comment on the overall methodological quality (including the score) as you determined from your assessment of the article. Comment on anything you believe was missing in the paper.] |
| Study strengths   * PEDro score=9/11; RCT; level of evidence=1b indicating a low rate of bias and a high level of validity for the study evidence * Subjects were selected from a heterogeneous population of frail elderly therefore results can easily be applied to a population of physical therapy patients * Clinical criteria for frailty were compared to a gold standard clinical measure of frailty * Frail elderly are deconditioned and need interventions that improve strength, quality of life and reduce risk of falls * No statistical differences in the subjects at baseline * Study interventions were low cost, simple and easy to administer in any setting * The 2 x 2 factorial study design investigated the effects of 2 potential interventions on primary and secondary outcome measures * Subjects were randomly allocated to one of four treatment groups * Exclusion criteria were appropriate for the study: poor prognosis, MMSE<20/30, physical limitations for exercise, unstable cardiac condition, large ankle ulcers, geographic limitations and non-fluency in English * No subjects were lost to the study, however an intention to treat analysis was performed to account for those who died or dropped out * Obtained p values for each relevant study statistic * Confidence levels at 95% were reported for each relevant statistic   Study limitations   * Exercise treatment was not standardized for each subject * Exercise protocol was not disclosed or validated * Treating therapist was not the same for all subjects thereby introducing high variability in treatment approach * Exercise treatments alternated between a therapist visit and a phone call without a clear description of the treatment scheduling * Measures of strength using a hand-held dynamometer were not described therefore testing positions may have affected test results * Researchers did not confirm their findings with a second set of subjects * Setting in the home introduced a wide variability in the treatment application and conditions * Lack of standardized exercise protocol for treatment subjects * No mention of masked status of physical therapists performing the intervention * No objective measure of improved physical performance measures in the first 3 months as the study reported * No discussion of the normal amount of vitamin D supplementation needed for healthy or frail subjects * Increased risk ratio of musculoskeletal injury with exercise intervention=3.6, 95% CI=1.5-8.0 * Significant increase in fatigue p=.002 with resisted exercise   The study made a loose connection between resistance exercise in frail elderly and a focus on the quadriceps as a muscle that can prevent falls in the frail elderly. The authors did not cite evidence that quad strengthening alone prevents falls, especially open chain quadriceps strengthening. The design may have been more accurate if the authors connected the function of balance with a functional measure of strength such as a sit to stand activity, not a quadriceps exercise. The strength of the study may have been increased by standardizing treatment frequency, exercise protocol, treatment conditions (ie chair height, etc.), and treatment personnel.  The study did not reveal the cause of the subjects’ falls and lack of quadriceps strength is an unknown cause. Other falls risk reduction factors such as safety education and environmental modifications are known to reduce the risk of falls. If I were to re-design the study, the treating therapists would be trained in use of 1 RM exercise techniques for the elderly and would be present at each intervention. The exercise protocol (intensity, frequency and duration) and progression would be objective and clearly documented. I would compare resistive exercises and education to education alone to reduce falls risk. Education as a control would address many environmental factors that prevent falls and the study would assess the effect of resistive exercise as a main intervention. |
| **Interpretation of Results**  [This is YOUR interpretation of the results taking into consideration the strengths and limitations as you discussed above. Please comment on clinical significance of effect size / study findings. Describe in your own words what the results mean.] |
| We can reject the aim of the study that exercise and vitamin D supplementation improves quality of life and reduces the risk of falls in frail, elderly individuals discharged home from the hospital. The results of the study indicate that isolated, resisted quadriceps exercises have no significant effect on falls or on quality of life and do not prevent falls. Without direct supervision, performing high intensity quadriceps exercises at 60-80% produces a high level of injury and may not be appropriate for the frail population. In addition, the treatment intervention of 3 sets of 8 daily may not be sufficient to produce a significant change in quadriceps strength for falls prevention. The study did report “improvement” in physical measures across all measures in the first 3 months however, resisted exercises to the quadriceps did not have any significant effect on measures related to quality of life, balance, ADL’s or functional activities either in the frail elderly at 3 or 6 months. Further study with an age-appropriate exercise protocol may demonstrate clinical significance in effect of exercise. Other adjustments would be to train physical therapists how to treat frail elderly using 1RM formulation in order to avoid musculoskeletal injury in the subjects.  The results of this study did not demonstrate any relationship between Vitamin D consumption and quality of life or falls reduction. There was no effect on vitamin D on either the primary or secondary measures of balance, ADL’s, functional activities and strength. There was, however an increase in the mean amount of vitamin D in certain groups at 3 and 6 months post baseline but not significant enough to affect the primary or secondary outcome measures. Perhaps an increase in the dose may make a significant change in the effect on quality of life, falls risk, balance and other functional activities.  The mean effect size of the treatment and controls was neither statistically nor clinically significant in any of the secondary outcome measures. The sample size was sufficient at 243 based on projected a priori of 240 with a power of 80% and an alpha of 0.005 for highlighting a 10% difference between treatment groups. |

**(2) Description and appraisal of: Is Lower Extremity Strength Gain Associated with Improvement in Physical Performance and Disability in Frail, Community-Dwelling Elders? By Chandler JM, Duncan PW, Kochersberger G, and Studenski S. (1998)**

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| **Aim/Objective of the Study/Systematic Review:** |
| The purpose of the study was to whether strength gain in the lower extremities is associated with improved physical performance and disability in a frail elderly population of community dwellers. |
| **Study Design** |
| * A randomized, controlled trial with a prospective design * Subjects were volunteers recruited from various hospitals, medical agencies and social programs within a 25 mile radius of Durham Veterans Affairs Medical Center (DVAMC) * Subjects screened by a geriatrician then were block-randomized and stratified by two levels of functioning: higher functioning and lower functioning * Level of function was determined by participant’s chair rise ability with or without use of their arms * Baseline testing of strength, performance and disability were assessed prior to the study * Post intervention measures were taken within 5 days of ending the exercise/control intervention * Examiners who assessed pre and post intervention measures were blinded to the subject’s intervention status * Post-test examiner was blinded to pre-test score and intervention status of the subjects * Control subjects were offered the exercise protocol following the study * Exercise protocol based upon subject’s initial strength capacity; progression based upon general resistive exercise principles using Theraband * Variable study environment as the interventions were performed in subject’s homes |
| **Setting** |
| * Pre and post-test locations: Subjects were tested in a hospital outpatient laboratory * Treatment locations: Subjects each received intervention treatment in their own home. |
| **Participants** |
| * 100 total subjects were recruited to the study. 50 male and 50 female * Method of recruitment: was not specifically stated, however, subjects were recruited from areas within a 25 mile radius of DVMAC including from medical clinics and social programs. * Inclusion criteria for subjects: Community dwelling, older than 64 years old, defined as “frail” (by stair descending ability without use of handrail while using a reciprocal step pattern) * Block-randomized then stratified into two functional levels: high and low * Mean age: 77.6 years (SD 7.6) * Gender: male= 50; female=50 * Baseline comparisons showed no statistical difference for any variables * No subjects lost to follow up. * Drop outs=13. Control=7, Exercise=6. Illness=9. Death=1. Loss of interest=1. Hip pain=1. No post-test follow up strength training=1 * 87 subjects completed the study |
| **Intervention Investigated** |
| *Control* |
| * Control subjects did not change their current level of activity * No initiation of new exercises during the 10 week period for the control subjects * Control subjects were offered to complete the exercise after the completing the post-test data collection |
| *Experimental* |
| * Subjects performed resisted Theraband exercises 3 times per week for 10 weeks following strength training principles outlined by the American College of Sports Medicine * Exercise sessions were supervised by a physical therapist * Intervention was performed in each subject’s home * Initial strength capacity of the exercise participant was measured by the participant’s ability to lift Theraband for 6 to 8 repetitions with good quality prior to onset of fatigue * Subjects in experimental group progressed to a more difficult resisted band when they could perform 2 sets of 10 repetitions using the current band * Resisted lower extremity exercises included hip extension, hip abduction, knee flexion, knee extension, and ankle dorsiflexion. No positioned stated. * Functional resisted exercises included chair rises, toe rises and stair-stepping. No specific repetitions or progression was outlined. * Each exercise session began with a 5-minute warm-up consisting of stretching and marching in place. No specifics given |
| **Outcome Measures** (Primary and Secondary) |
| Primary Outcome Measures: The testing was performed in an outpatient hospital laboratory. The testing individual was blinded to participants’ intervention status.   * Strength: A Cybex 6000 isokinetic dynamometer assessed bilateral isokinetic and isometric knee flexion and extension at 60 degrees/sec; ankle dorsiflexion and plantarflexion at 30 degrees/sec. The last 3 of 5 repetitions were recorded and averaged. Isometric hip abductor strength was measured with a Nicholas handheld dynamometer. The mean peak torque of three test trial was calculated. Pre and post strength measures were compared each other * Physical performance measures: Balance-Functional reach, spontaneous postural sway; falls efficacy scale; walking (6MWT and gait speed); mobility; and chair rise. * Functional reach: assesses static balance by having the individual reach forward as far as possible. Frail elderly and community dwelling risk for falls are < 18.5 cm and < 7 inches respectively. The mean of the last 3 of 5 trials was averaged. * Spontaneous postural sway measured on a force platform with eyes closed. No norms were given. Maximum excursion during each of two-30 second trials was averaged. * Falls efficacy scale: Participant confidence of not falling during household activities. Rated on a 10 point Likert scale. 1=very confident; 10= not confident at all. Maximum score=100. Greater than 70=fear of falling. * 6-minute walk test (6MWT): Assesses aerobic capacity/endurance after a walk for 6 minutes. Mean distance for males 60-69=572 m, females 60-69=538 m; males 70-79=527 m, females=471 m; males 80-89=417 m, females=392 m. * Gait speed: Measures the speed of a subject over a 5 meter distance. Interpretation: <.04m/sec=household ambulator; 0.4-0.8 m/sec=limited community ambulator; 0.8-1.2 m/sec=community ambulatory; 1.2 m/sec=able to cross streets safely. * Mobility Skills Protocol: 13 mobility items that measure static and dynamic balance. Scored on a 3-point ordinal scale. No other scoring details given. * Chair rise: Participants stood up from six randomly ordered seat heights from 13”-23”. Inability to rise from a chair without use of arms constituted a failure. Lowest successful chair rise height was recorded. A score of six is the highest and best score. No further details were given. * Disability measure: Medical Outcomes study health survey (MOS-36). Self-report that measures health-related quality of life. 36 items divided into 8 subscales and 2 domains. Weighted Likert system is used for each item. 8 subscales are summed and transformed to a 0-100 scale. Each domain mean scored is 50.   Secondary Outcome measure: Depression scale (Geriatric Depression Scale).   * A self-reported, yes/no, 11-item measure of depression and suicide ideation in elderly. A score >11 indicates depression. |
| **Main Findings** |
| Initial data   * Baseline data reveal a moderately limited population in all strength, physical performance and disability measures * Significant initial gender differences for females in chair rise only (p=.04) * Baseline data for mean measures of strength, physical performance and disability are not significant for any variable (p=.05)   After 10 weeks of intervention   * Strength gains were significant for strength training group compared to controls (.001-.06 for different muscle groups) * Linear regression data compared mean effect of change in strength with physical performance and levels of disability at post-test measures. No description of confidence intervals noted. * Change in strength demonstrated a significant relationship with increased mobility skills performance (p=.0009), increase in gait speed (p=.02) and gains in falls efficacy (p=.05) * No significant relationship between change in strength and 6 minute walk distance (p=.12), functional reach (p=.87), static sway (p=0.6), or MOS-36 physical scale (p=0.6) |
| **Original Authors’ Conclusions** |
| The authors concluded that frail elderly did make significant gains in strength, mobility and various measure of performance with a resistive exercise home program conducted by a physical therapist. Their low-tech, low-to moderate intensity approach using Theraband was an effective method for creating significant change in lower extremity strength and therefore may have an impact on lower extremity tasks such as chair rise ability, transfers, gait, stooping and stair climbing. The resisted exercise protocol, however, was not effective in producing change in measures of balance, improved endurance or disability. Limiting factors regarding strength gains discussed by the authors involved the definition of frailty, the specificity of exercise and the responsiveness of the outcome measure. Because the level of frailty in this study involved chair rise, there would have been a difference in response between the higher and lower level functioning elderly, training the quads may not have been task-specific to affect chair rise and use of timed chair rise may have been a more appropriate outcome measure for this study. This study had no impact on measures of balance because of the variability in performance after a few months and due to poor specificity of training. The training approach for muscles designed for force and power generation differ from an intervention designed to elicit muscle reactions required for balance responses. The authors state a difference in timing and contraction type where slow, concentric muscle contractions used with the Theraband differ from the quick, eccentric muscle contractions needed for balance. Even though strength gains had no impact on balance, there were significant gains in falls efficacy suggesting that the perception of safety improves after a strengthening program. The authors suggest that endurance with the 6MWT did not improve because of the poor relationship between the training intervention and the training intensity and duration. Higher intensity training over a longer duration, may lead to increased endurance change. There was no association between change in strength relative to measures of physical performance in the MOS-36. Choice of the appropriate outcome measure is important with regard to the MOS-36 that reflects higher level function rather than lower functional ADL’s associated with the frail elderly. The authors suggest that the MOS-36 may not have been sensitive enough to detect changes in household function performed by frail elderly. |
| **Critical Appraisal** |
| **Validity**  [Identify the strengths and limitations of the study, including potential sources of bias. Comment on the overall methodological quality (including the score) as you determined from your assessment of the article. Comment on anything you believe was missing in the paper.] |
| Study strengths   * PEDro score=6; RCT; Level 1b evidence; Indicates fair bias with high level of validity for the study evidence * Subjects were randomly assigned to treatment or control groups * No subjects were lost to follow up * Attrition rate of the subjects was less than 20% thereby reducing chance for increased bias * Subject selection was drawn from multiple facility types and organizations and therefore generalizable to a general population of frail elderly * Baseline characteristics did not vary significantly between intervention and control groups * Appropriate use of inclusion and exclusion criteria * Baseline data was collected by an individual who was blinded to the intervention/control group * Subject status was concealed to individual who collected the post-test measures * Outcome measures were clearly defined   Study weaknesses   * No intention to treat analysis for reduced sample size * No clear description of the intention vs control group composition * Inappropriate selection of intervention for outcome measures of balance, depression, endurance and physical scale. (Outcome measure was not sensitive enough or intervention was not of adequate intensity, duration or contraction type). * Definition of frailty in this study is not the current “gold standard” definition of frailty * Exercise treatment protocol was not specified or validated for all exercises * Exercise treatment was not standardized for each subject * Exercise treatment was not performed by the same treating therapist * The home environment introduces a wide variety of treatment conditions. No attempt to standardize treating conditions in the home setting * Investigators did not confirm their findings on a second set of subjects * Lack of predictive factors for the power of the study * Published 26 years ago   The study was clear in its goals to increase strength in a frail elderly population and this study did demonstrate strength gains using low tech-devices in a home setting. In addition to strength gains in the lower extremities, there was significant association of strength increase with mobility skills, gait velocity and falls efficacy. Strength gains were not associated with improvements in balance, endurance or measures of disability. Unfortunately, it was not clear if the intervention subjects were women and the control subjects were men, therefore the application of the results to a general population is difficult to make. In addition, because the parameters of the treatment protocol were not detailed, it is unknown if the intensity, duration and frequency the exercises was insufficient for meeting other outcome measures. The choice to delineate high and low levels of frailty based upon chair rise ability was not based upon a validated gold standard of delineation. To increase the validity of this study, confidence intervals and predictive power of the study should be included. To reduce bias in the study, an intention to treat analysis could have been performed in the absence of the 13 study participants and follow-up data could have been collected after the control group completed the exercise treatment. Since some of the treatment exercises were dynamic, use of a different outcome measure such as the Berg Balance test or Timed Up and Go may have helped to capture improvements in balance better than the functional reach. |
| **Interpretation of Results**  [This is YOUR interpretation of the results taking into consideration the strengths and limitations as you discussed above. Please comment on clinical significance of effect size / study findings. Describe in your own words what the results mean.] |
| The results of the study provide evidence that frail patients can make strength gains using Theraband in the home setting while under the supervision of a physical therapist. Therapists can design a simple treatment using cost-effective tools to assist with strength training for their frail patients. In addition to strength gains, patients may increase their confidence for avoiding a fall and further, they may demonstrate improvement in a variety of critical mobility skills such as transfers, gait and stairclimbing. Although the data showed between 10-16% strength gains in the muscles of the treatment group, there was no description of what percentage of strength gain is clinically significant. The 5 time sit to stand or the 30 second chair rise may have been an appropriate functional outcome measure of strength. I agree with the authors regarding the need for specificity of training for the subjects. If the intervention group incorporated varied intensity, frequency, duration and mode of exercise, the subjects may have demonstrated greater improvement in the dynamic portions of muscle functions. Due to the limitations of the study, the clinician cannot be certain if the results apply to a population of men or of women or if the number of subjects in the sample has sufficient power to garner a significant treatment effect. |

**(3) Description and appraisal of The Effect of a 12-week Dynamic Resistance Strength Training Program in Gait Velocity and Balance of Older Adults by Topp R, Mikesky A, Wigglesworth J, Holt W, Edwards, J. 1993.**

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| **Aim/Objective of the Study/Systematic Review:** |
| The objective of the study was to assess the effect of resisted exercises in elderly adults on gait velocity and balance. The authors tested 3 hypotheses: 1) Following 12 weeks of dynamic resistance training gait velocity in older adults will change compared to controls. 2) Dynamic measures of balance in elderly adults will demonstrate significant improvement over a control group after 12 weeks of resisted exercise training. 3) Static measures of balance (eyes open and eyes closed) in elderly adults will significantly improve over controls following 12 weeks of resistance training. |
| **Study Design** |
| * A randomized clinical trial * Subjects were recruited through an undisclosed method from community dwellers aged 65 or older * Potential subjects were screened and then randomly assigned to a treatment group (exercise) or a control group (driver’s education) * Blinding of the screener, assessor or training staff was not evident in the study description * Additional exercise classes were offered to the treatment group to promote adherence to the study * Outcome measures were assessed at baseline and again at 12 weeks post baseline * Two-way ANOVA was used to test the three hypotheses * A priori power calculation was conducted to detect changes with an alpha = .05 a sample size of 25 and with effect sizes for balance and gait velocity measures * No intention to treat data analysis |
| **Setting** |
| * Subjects received one of the three weekly exercise interventions in a group setting * Remaining two sessions were performed at home |
| **Participants** |
| * 63 total subjects recruited to the study. Controls=32; 14 male, 18 female. Exercisers=31; 10 male, 21 female * Recruitment method was not disclosed * Inclusion criteria: community dwelling adults aged 65 or older. Exclusion criteria was specifically stated * Gender: 24 male, 39 female * Mean age: Controls=72.8 years (SD 1.0); Exercisers=69.2 (SD .8). Significantly different at the p<.05 level * Baseline comparison for gender, health, balance and strength showed no statistical difference at the p<.05 level * Significant difference for gait speed between intervention and control group (p< .05) * No subjects were lost to follow up * Drop outs N =7. Control N=2 due to non-randomization into the exercise group. Exercisers N=5; 3=too time consuming, 1=stroke, 1=exacerbation of emphysema * 55 subjects completed the study. Controls N=30; 13 male, 17 female. Exercisers N=25, 8 male, 17 female |
| **Intervention Investigated** |
| *Control* |
| * Controls attended two 3-hour driver education classes * Controls were asked to continue with normal level of physical activity for the study duration |
| *Experimental* |
| * Strength training group used an exercise booklet for exercise instruction * Participants in the strength training group were given 5 thicknesses of surgical tubing as exercise equipment * Subjects in the strength training group were provided with an exercise log to document home exercise adherence * Training group performed one set of 10 repetitions to moderate fatigue for each exercise at the initial session. * Exercise intensity progression to the next heaviest tube was determined when the subject could lift the exercise band 12 or more repetitions to fatigue * Upon completion of the study, all exercise subjects completed 2 sets of 10 repetitions for upper extremity and 3 sets of 10 for the lower extremity to moderate fatigue * Exercise protocol included a 5 minute stretching warm up, 50 minutes of resisted exercises and 5 minutes stretching cool down * Exercise muscle groups were: 6 upper body and 6 lower body * Frequency of exercise was 3 times per week. Once a week in a group setting and twice a week at home * Subjects documented the exercise adherence in an exercise log |
| **Outcome Measures** (Primary and Secondary) |
| Primary measure: Gait velocity   * Gait velocity or 10 Meter Walk Test (TMWT) assesses walking speed in meters per second. Participants in this study walked barefoot for 10 meters at a comfortable speed. The middle 3 meters were recorded as the subject’s speed. The average of 10 trials was used in this study as the gait speed for the participant   Secondary measures: Static and dynamic balance   * Static balance (eyes open) assesses fall risk via single limb stance (SLS) where the participant stands barefoot on one limb while the other is flexed to 90 degrees. The hands are on the hips while the tester times the participant. The participant is at risk for falls if loss of balance occurs before 5 seconds. * Static balance (eyes closed) was assessed as above with the eyes closed. * Static tests were recorded as the average of two timed trials * Normative data for mean scores (eyes open and eyes closed) are available for age and gender. * Dynamic balance was assessed by having the subjects walk backwards on a 1-inch tape in a tandem fashion for 8 feet. * Dynamic balance errors were counted as the number of times the individual stepped off the tape * Dynamic balance was computed as the average of errors on two trials. Higher numbers indicated decreased dynamic balance. No norms or cut-off values were given. |
| **Main Findings** |
| Baseline data   * Intervention and control groups were not statistically different (p<.05 level) regarding demographic presentation, health status and balance measures except for age and gait velocity * Control group was older and slower at baseline compared to exercise group * Significant effect for gait velocity for pre and post test scores of exercise group. Intervention group was slower post exercise (mean of treatment effect=.05 m/sec) (p<.01) * Post-test gait velocities were not significantly different between intervention and control groups * Significant treatment effect for eyes open static balance in both groups. Measure increased for both groups (p<.001). Gain of approximately 8.5 seconds * Significant treatment effect for eyes closed static position. (p<.001) Control group demonstrated a significant decrease in eyes closed condition (mean=.76 seconds). * No significant change in eyes closed static position with exercise group * Significant treatment effect on dynamic balance. (p<.001). Exercise group committed fewer errors at post-test compared with pre-test measures (mean=0.9 seconds). * No significant change in dynamic balance with control group. (mean=.02 errors) * Post-test treatment effect of isokinetic strength was significant between exercise group and the control group. (mean=31 Newtons) * Post-test treatment effect of isokinetic eccentric knee strength in exercise group increased compared to control group (mean=29 Newtons * 100% exercise subjects completed the program. 90% completed supervised and 86.6% completed unsupervised portion of the study |
| **Original Authors’ Conclusions** |
| The authors rejected the three hypotheses of a positive impact of strength on gait velocity and balance measures. However, they view the results as positive indication for the potential for change because the results were moving in the predicted direction. Positive changes were noted in the percent increase of muscle strength (74%, p<.01) in the resisted exercise group supporting other research results. There was conflict regarding the progression of gait velocity in the elderly with some data reporting an increase in speed as normal and other data reporting a decrease in speed as normal for the elderly. Gait velocity decline results were presented as modulation of speed from the higher than normal baseline speed to a lower, more normal post intervention speed. The authors attributed the increase in static balance measures in both groups to the subjects possibly practicing the maneuver during the test period. Overall, the authors concluded that the resisted exercise program was beneficial for ease of duplication, increased compliance, increase in lower extremity strength and low cost. In addition, the program allowed for individual feedback on form and technique by the staff during the once weekly group session. Due to the low injury level, the authors further conclude that the unsupervised and supervised combination of resisted exercises is safe for the elderly to perform. The authors report possible positive interactions between strength training and gait velocities and dynamic balance. Acknowledged limitations to the study include unblinded subjects who were self-selected and healthier than the average American elderly individual. Additionally, the authors did not capture other measures of balance such as changes in postural sway or center of gravity. |
| **Critical Appraisal** |
| **Validity**  [Identify the strengths and limitations of the study, including potential sources of bias. Comment on the overall methodological quality (including the score) as you determined from your assessment of the article. Comment on anything you believe was missing in the paper.] |
| Study strengths   * PEDro score=6/10; RCT; Level 1b indicating fair bias level and a strong level of validity for the study evidence * Population included an appropriate population of community dwelling elder adults * Sample size predicted a priori with an adequate sample size for power * Outcome measures of gait velocity, static and dynamic balance were clearly defined * Exclusion criteria were specifically identified as presence of cardiovascular/cardiopulmonary disease, exercise intolerance, functional disability, or those unable to meet the time commitment or those involved in a strengthening program * Subjects were randomized into treatment or control group * Study included a control group for comparison of treatment effect   Subjects received feedback on exercise form from a project staff member   * Participants were of similar pre-test demographics with the exception of age and gait velocity * Key outcome measures were achieved in >85% of subjects * Between group statistical comparison was made for at least one outcome measure * Study provides both point measures and measures of variability for at least one outcome measure   Study limitations   * Lack of specific eligibility criteria * Selection of study subjects was from healthy spectrum of older adults * Adherence to the program was reinforced with a promise of additional post-test exercises * Allocation to study group was not concealed * Treating staff were not blinded to treatment/control groups * Assessors were not blinded at pre or post-test measures * No intention to treat data for the participants who dropped out of the study * Dynamic balance measure did not have a gold standard * Gait velocity was not identified as fastest or self-selected speed * Treatment group performed exercises as outlined in a booklet. No physical therapist intervention * Exercised muscles in the treatment group were not identified * No medical qualifications given for the project staff * Lack of specified exercise protocol for the treatment group * Exercise intensity was designed for minimal increase in heart rate or blood pressure * Static and dynamic outcomes lacked MCD/MCID measures * Study is published 22 years ago   The study established its 3 hypotheses clearly, however the relationship between strength and gait velocity was never studied before therefore the results regarding gait speed had conflicting opinions. Even though each of the balance measures was reproducible, there were no objective means of measuring progress in the SLS or the backward tandem ambulation items. Use of a more standardized balance measure such as the Berg Balance Scale or the Timed up and Go may have been more appropriate. Those balance measures may better capture components of gait velocity, static and dynamic balance. There are principles for progressive resistive exercise using Theraband and should have been described in the study. In addition, a detailed description of the exercises that the individuals performed would have made the intervention strategy clearer. The discussion referring to change in gait velocity in older adults was conflicting and the authors ultimately concluded that as they age, older adults normally increase speed to capture a forward moving center of gravity. In my clinical experience, normal older adults will decrease their gait speed, decrease stride length and spend more time in double support in order to become stable during gait. The subjects in this study lacked pathology that would suggest a forward moving center of gravity during normal gait. If I were to make any change in the study it would be to have medical professional supervision by a physical therapist in order to insure proper form and to insure adequate training effect with a safe, yet appropriate increase in pulse and respiration rate. In addition, I would assess any functional change in status with a more comprehensive outcome measure. |
| **Interpretation of Results**  [This is YOUR interpretation of the results taking into consideration the strengths and limitations as you discussed above. Please comment on clinical significance of effect size / study findings. Describe in your own words what the results mean.] |
| We can reject all 3 hypotheses. Strength training in the elderly will not transfer to improved gait speed or to static balance with eyes closed. Performing progressive, resistive exercise can, however, positively impact static balance in the eyes open single limb stance condition and with a dynamic gait activity such as retro, tandem walking. The test results can be generalized to a heterogeneous population of healthy community dwelling older adults. The results of the study did indicate, however, that older adults can perform progressive resisted exercise without injury and make strength gains. Use of Theraband for extremity strengthening is an effect and cost-effective measure for the patient and for a clinical staff member. If given a structured home exercise program with a once weekly supervised group session, adherence to the exercise program can be high for a 12-week period. There were significant treatment effects for several outcome measures but the selected outcome measures did not have objective measures of clinical significance. Therefore, it is unknown if the positive results would have clinical relevance with a patient population of older adults. |

**EVIDENCE SYNTHESIS AND IMPLICATIONS**

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| Falls among the elderly and frail elderly are a health care crisis. Approximately 30% of community dwelling elderly over 65 years old fall annually and 25 % will sustain a serious injury as a result of the fall. Additionally, other factors such as confidence, quality of life and physical function suffer after an elder individual experiences a fall. According to the WHO, a fall is described as “an event which results in a person coming to rest inadvertently on the floor, or ground or other lower level”. In light of the alarming incidents of falls amongst the elderly, physical therapists need to provide effective interventions to reverse or slow the trend of falls.  The intervention in question relates to strengthening exercises for the elderly in a seated position. The review of this literature attests to the benefit of performing progressive resisted strengthening exercises in the elderly population including community dwellers and the frail. Strengthening exercises achieved significant strength gains among the elderly when the exercises followed a specific protocol and were performed under the supervision of medical personnel. Subjects in the studies used low cost, easy to use equipment such as Theraband and cuff weights for the progressive strengthening intervention allowing for ease of duplication in the clinic or in the home setting.  Strength gains, however, did not translate into significant improvement regarding objective measures of balance for any of the studies. Clinically, this means that the treating clinician must add the appropriate intervention to the plan of care for the elderly patient which may include exercises besides lower extremity strengthening. Howe describes the importance of training subjects utilizing a task-specific approach, concluding that in order to achieve significant balance outcomes, the subject must be trained utilizing a dynamic balance approach.  In order to address the economic, medical and social crisis of falling in the elderly, the physical therapist cannot rely solely on seated strengthening exercise for significant balance changes. Progressive, resisted strengthening exercises are effective for improving strength in frail and community elderly therefore, the clinician may choose to initiate the intervention with strengthening exercises then progress to task-specific balance exercises as strength increases. To further enhance physical therapy intervention, an elderly patient can be issued a safe, cost-effective and effective home exercise program with high expectations that the patient will be adherent.  The increased fall rate in elderly adults raises concern for physical therapists in the clinic. Evidence-based techniques and interventions beyond strengthening exercises are required to decrease fall rate and the risk of future falls. The literature does not support strengthening exercises alone, therefore clinicians who work with elderly individuals at risk for falls should apply additional techniques to endure safety and reduction in falls for their clients.  Future research is required to investigate safe home exercise programs that an at-risk patient can safely execute. Seated exercises do not generate sufficient results to prevent falls or to reduce the risk of falls, therefore safe standing exercises may be the next appropriate area of research in the quest for effective fall reduction home exercises. A home exercise program in standing can be cost effective and safe as well as functional for the elderly patient at risk for falling. |

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