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Our Mission: Helping to prepare Iowa's health practitioners to care for our growing population of elders. *E-NEWS* is one of our methods of teaching through technology.

Each month, *E-NEWS* delivers abstracts from current multidisciplinary healthcare journal articles related to a specific geriatric topic. This month's *E-NEWS* focuses on STRENGTH AND FATIGUE WITH AGING.

STRENGTH AND FATIGUE WITH AGING

In this issue of the *E-NEWS*, you will find abstracts for:

- A study that seeks to determine the efficacy of nutritional supplementation in combination with physical activity on muscle mass and strength in older adults.
 - A study that aims to validate the Pittsburgh Fatigability Scale for older adults.
 - A study that analyzes research on physical activity and sarcopenia in the geriatric population.
 - A study that examines associations of midlife to late life fatigue with physical performance and strength in early old age.
 - A study that investigates whether fatigue is a long-term risk factor for limitations in instrumental activities of daily living and/or mobility performance in older adults after 10 years.
 - A study that addresses poor muscle strength and low physical activity as the most prevalent frailty components in community-dwelling older adults.
 - An article that evaluates the association among sarcopenia and its elements with depression and fatigue.
 - A study that explores the association of muscle endurance, fatigability, and strength with functional limitation and mortality in older adults.
 - A study that assesses the effects of six months of progressive high effort resistance training methods on strength, body composition, function, and well-being of older adults.
 - An article that discusses associations between aging-related changes in grip strength and cognitive function in older adults.
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- Englund DA, Kirn DR, Koochek A, Zhu H, Trivison TG, Reid KF, von Berens Å, Melin M, Cederholm T, Gustafsson T, Fielding RA. Nutritional Supplementation With Physical Activity Improves Muscle Composition in Mobility-Limited Older Adults, The VIVE2 Study: A Randomized, Double-Blind, Placebo-Controlled Trial. *J Gerontol A Biol Sci Med Sci.* 2017 Dec 12;73(1):95-101.

Background: Nutritional supplementation and physical activity have been shown to positively influence muscle mass and strength in older adults. The efficacy of long-term nutritional supplementation in combination with physical activity in older adults remains unclear. Methods: Mobility-limited (short physical performance battery [SPPB] ≤9) and vitamin D insufficient (serum 25(OH) D 9-24 ng/mL) older adults were recruited for this study. All subjects participated in a physical activity program. Subjects were randomized to consume a daily nutritional supplement (150 kcal, 20 g whey protein, 800 IU vitamin D, 119 mL beverage) or placebo (30 kcal, nonnutritive, 119 mL). In a prespecified secondary analysis, we examined total-body composition (dual energy X-ray absorptiometry), thigh composition (computed tomography), and muscle strength, power, and quality before and after the 6-month intervention. Results: One hundred and forty-nine subjects were randomized into the study [mean (standard deviation, SD) age 78.5 (5.4) years; 46.3% female; mean (SD) short physical performance battery 7.9 (1.2); mean (SD) vitamin D 18.7 (6.4) ng/mL]. After the intervention period both groups demonstrated improvements in muscle strength, body composition, and thigh composition. Nutritional supplementation lead to further losses of intermuscular fat (p = .049) and increased normal muscle density (p = .018). Conclusions: Six months of physical activity resulted in improvements in body composition, subcutaneous fat, intermuscular fat, and strength measures. The addition of nutritional supplementation resulted in further declines in intermuscular fat and improved muscle density compared to placebo. These results suggest nutritional supplementation provides additional benefits to mobility-limited older adults undergoing exercise training. ClinicalTrials.gov Identifier: NCT01542892. ©The Author.



- Glynn NW, Santanasto AJ, Simonsick EM, Boudreau RM, Beach SR, Schulz R, Newman AB. The Pittsburgh Fatigability scale for older adults: development and validation. *J Am Geriatr Soc.* 2015 Jan;63(1):130-5.

OBJECTIVES: To describe the development of the Pittsburgh Fatigability Scale (PFS) and establish its reliability and concurrent and convergent validity against performance measures. DESIGN: Cross-sectional. SETTING: University of Pittsburgh, Pittsburgh, Pennsylvania. PARTICIPANTS: Scale development sample: 1,013 individuals aged 60 and older from two registries; validation sample: 483 adults aged 60 and older from the Baltimore Longitudinal Study of Aging (BLSA). MEASUREMENTS: The scale development sample and BLSA participants self-administered an initial 26-item perceived fatigability scale. BLSA participants also completed measures of performance fatigability (perceived exertion from a standard treadmill task and performance deterioration from a fast-paced long-distance corridor walk), a 6-m usual-paced corridor walk, and five timed chair stands. RESULTS: Principal components analysis with varimax rotation reduced the 26-item scale to the 10-item PFS. The PFS showed strong internal consistency (Cronbach's alpha 0.88) and excellent test-retest reliability (intraclass correlation 0.86). In the validation sample, PFS scores, adjusted for age, sex, and race, were greater for those with high performance fatigability, slow gait speed, worse physical function, and lower fitness, with differences between high and low fatigability ranging from 3.2 to 5.1 points (P < .001). CONCLUSION: The 10-item PFS physical fatigability score is a valid and reliable measure of perceived fatigability in older adults and can serve as an adjunct to performance-based fatigability measures for identifying older adults at risk of mobility limitation in clinical and research settings. ©the Authors Journal compilation.



- Lee SY, Tung HH, Liu CY, Chen LK. Physical Activity and Sarcopenia in the Geriatric Population: A Systematic Review. *J Am Med Dir Assoc.* 2018 May;19(5):378-383.

INTRODUCTION: Sarcopenia is an aging-related health problem in the geriatric population. Sarcopenia reduces muscle mass, muscle strength, and physical performance. Although physical activity is protective against sarcopenia for older adults, there are limited studies in this area. The purpose of this study was to integrate and analyze research on physical activity and sarcopenia in the geriatric population. METHODS: Studies that assess sarcopenia were searched across electronic databases that included Medline, PubMed, CINAHL, and Cochrane Database of Systematic Reviews. Studies that implemented physical activity-related intervention or research were included. A critical appraisal skills program was used for quality assessment of

the selected articles. Study selection and data extraction were counted by 2 independent reviewers. RESULTS: Of the 149 references identified through the database search, 10 studies were included in this systematic review. Seven studies were randomized controlled trials, and 3 were cross-sectional or longitudinal. The results of 8 studies indicated significant improvement in muscle mass, muscle strength, and physical performance through exercise intervention, as determined by long-term observation. CONCLUSIONS: Physical activity is an effective protective strategy for sarcopenia. Most studies of older adults exercise intervention indicated that the participants achieved positive results, but maintenance of muscle strength appeared to depend on continuous implementation of certain types of physical activities. A limitation of these 10 reviewed studies was that there was no consistency in the measurement of sarcopenia. Therefore, sarcopenia measurement needs further investigation. ©AMDA.

- Mänty M, Kuh D, Cooper R. Associations of Midlife to Late Life Fatigue With Physical Performance and Strength in Early Old Age: Results From a British Prospective Cohort Study. *Psychosom Med*. 2015 Sep;77(7):823-32.

OBJECTIVES: To examine associations of fatigue in midlife and later life with physical performance and strength in early old age. METHODS: Data on approximately 1800 men and women from the UK Medical Research Council National Survey of Health and Development with data on fatigue at ages 43 and 60 to 64 years were used. Fatigue was defined as perceived tiredness and was assessed prospectively at ages 43 and 60 to 64 years. At both ages, participants were categorized as having no, occasional, or frequent fatigue. Physical performance and strength were measured at age 60 to 64 years using four objective measures: grip strength, standing balance, chair rising, and timed get-up-and-go (TUG) tests. RESULTS: There were associations between reports of frequent fatigue at both ages and poorer grip strength, chair rise, and TUG performance at 60 to 64 years. Furthermore, individuals reporting frequent fatigue at both ages had weaker grip strength ($\beta = -4.09$ kg, 95% confidence interval [CI] = -6.71 to -1.48) and slower chair rise ($\beta = -4.65$ repetitions/min, 95% CI = -6.65 to -2.64) and TUG ($\beta = -4.22$ cm/s, 95% CI = -12.16 to -2.28) speeds when compared with those who reported no fatigue at both time points. These associations were robust and were maintained after adjustment for a range of covariates including physical activity and health status. CONCLUSIONS: Reports of frequent fatigue were associated with poorer physical performance in early old age, especially if sustained from midlife to later life. These findings indicate that it is not just fatigue but fatigue sustained across adulthood that has implications for later life functioning.

- Mueller-Schotte S, Bleijenberg N, van der Schouw YT, Schuurmans MJ. Fatigue as a long-term risk factor for limitations in instrumental activities of daily living and/or mobility performance in older adults after 10 years. *Clin Interv Aging*. 2016 Nov 9;11:1579-1587.

OBJECTIVES: Decline in the performance of instrumental activities of daily living (IADL) and mobility may be preceded by symptoms the patient experiences, such as fatigue. The aim of this study is to investigate whether self-reported non-task-specific fatigue is a long-term risk factor for IADL-limitations and/or mobility performance in older adults after 10 years. METHODS: A prospective study from two previously conducted cross-sectional studies with 10-year follow-up was conducted among 285 males and 249 females aged 40-79 years at baseline. Fatigue was measured by asking "Did you feel tired within the past 4 weeks?" (males) and "Do you feel tired?" (females). Self-reported IADLs were assessed at baseline and follow-up. Mobility was assessed by the 6-minute walk test. Gender-specific associations between fatigue and IADL-limitations and mobility were estimated by multivariable logistic and linear regression models. RESULTS: A total of 18.6% of males and 28.1% of females were fatigued. After adjustment, the odds ratio for fatigued versus non-fatigued males affected by IADL-limitations was 3.3 (P=0.023). In females, the association was weaker and not statistically significant, with odds ratio being 1.7 (P=0.154). Fatigued males walked 39.1 m shorter distance than those non-fatigued (P=0.048). For fatigued females, the distance was 17.5 m shorter compared to those non-fatigued (P=0.479). CONCLUSION: Our data suggest that self-reported fatigue may be a long-term risk factor for IADL-limitations and mobility performance in middle-aged and elderly males but possibly not in females.

- Papiol M, Serra-Prat M, Vico J, Jerez N, Salvador N, Garcia M, Camps M, Alpiste X, López J. Poor Muscle Strength and Low Physical Activity Are the Most Prevalent Frailty Components in Community-Dwelling Older Adults. *J Aging Phys Act.* 2016 Jul;24(3):363-8.

OBJECTIVE: To determine the prevalence of five physical frailty phenotype components and to assess the relationship between them and other clinical factors. METHOD: A population-based cross-sectional study was performed. Subjects 75 years and older were randomly selected from primary care databases (with sampling stratified by gender). Physical frailty phenotypes were assessed using Fried's criteria. Sociodemographic data, comorbidities, nutritional status, and functional capacity were assessed. RESULTS: 126 subjects were recruited (47% women). Prevalence rates were poor muscle strength: 50%; low physical activity: 29%; slow gait: 28%; exhaustion: 27%; and weight loss: 5%. Prefrailty and frailty prevalence rates were 35.7% and 29.4%, respectively. Poor muscle strength and low physical activity showed a close relationship and concordance ($\kappa = 0.92$). Most frailty components were associated with outdoor activity, hours walked daily, and certain comorbidities. CONCLUSIONS: Poor muscle strength was the most prevalent frailty component and was closely associated with physical activity, suggesting that training programs may revert or prevent the frailty process.

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- Patino-Hernandez D, David-Pardo DG, Borda MG, Pérez-Zepeda MU, Cano-Gutiérrez C. Association of Fatigue With Sarcopenia and its Elements: A Secondary Analysis of SABE-Bogotá. *Gerontol Geriatr Med.* 2017 Apr 10;3:2333721417703734.

Objective: Sarcopenia, fatigue, and depression are associated with higher mortality rates and adverse outcomes in the aging population. Understanding the association among clinical variables, mainly symptoms, is important for screening and appropriately managing these conditions. The aim of this article is to evaluate the association among sarcopenia and its elements with depression and fatigue. Method: We used cross-sectional data from 2012 SABE (Salud, Bienestar y Envejecimiento)-Bogotá study, which included 2,000 participants of ages ≥ 60 years. Sarcopenia and its elements were taken as the dependent variable, while fatigue and depression were the main independent variables. We tested the association among these through multiple logistic regression models, which were fitted for each dependent variable and adjusted for confounding variables. Results: Our findings showed that gait speed was associated with fatigue (adjusted odds ratio [OR] = 1.41, 95% confidence interval [CI] = [1.05, 1.90], $p = .02$) as well as abnormal handgrip strength (adjusted OR = 1.40, 95% CI = [1.02, 1.93], $p = .04$). No other associations were significant. Conclusion: While sarcopenia and fatigue are not associated, two of the sarcopenia-defining variables are associated with fatigue; this suggests that lack of sarcopenia does not exclude undesirable outcomes related to fatigue in aging adults. Also, the lack of association between sarcopenia-defining elements and depression demonstrates that depression and fatigue are different concepts.

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- Roshanravan B, Patel KV, Fried LF, Robinson-Cohen C, de Boer IH, Harris T, Murphy RA, Satterfield S, Goodpaster BH, Shlipak M, Newman AB, Kestenbaum B; Health ABC study. Association of Muscle Endurance, Fatigability, and Strength With Functional Limitation and Mortality in the Health Aging and Body Composition Study. *J Gerontol A Biol Sci Med Sci.* 2017 Feb;72(2):284-291.

BACKGROUND: Mobility limitation is highly prevalent among older adults and is central to the loss of functional independence. Dynamic isokinetic muscle fatigue testing may reveal increased vulnerability to disability and mortality beyond strength testing. METHODS: We studied community-dwelling older adults enrolled in the Health Aging and Body Composition study (age range: 71-82) free of mobility disability and who underwent isokinetic muscle fatigue testing in 1999-2000 ($n = 1,963$). Isokinetic quadriceps work and fatigue index was determined over 30 repetitions and compared with isometric quadriceps maximum torque. Work was normalized to leg lean mass accounting for gender-specific differences (specific work). The primary outcome was incident persistent severe lower extremity limitation (PSLL), defined as two consecutive reports of either having a lot of difficulty or being unable to walk 1/4 mile or climb 10 steps without resting. The secondary outcome was all-cause mortality. RESULTS: There were 608 (31%) occurrences of incident PSLL and 488 (25%) deaths during median follow-up of 9.3 years. After adjustment, lower isokinetic work was associated with significantly greater risks of PSLL and mortality across the full measured range. Hazard ratios per standard deviation lower specific isokinetic work were 1.22 (95% CI 1.12, 1.33) for PSLL and 1.21 (95% CI

1.13, 1.30) for mortality, respectively. Lower isometric strength was associated with PSL, but not mortality. Fatigue index was not associated with PSL or mortality. CONCLUSIONS: Muscle endurance, estimated by isokinetic work, is an indicator of muscle health associated with mobility limitation and mortality providing important insight beyond strength testing. ©The Author.

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- Steele J, Raubold K, Kemmler W, Fisher J, Gentil P, Giessing J. The Effects of 6 Months of Progressive High Effort Resistance Training Methods upon Strength, Body Composition, Function, and Wellbeing of Elderly Adults. *Biomed Res Int.* 2017;2017:2541090.

PURPOSE: The present study examined the progressive implementation of a high effort resistance training (RT) approach in older adults over 6 months and through a 6-month follow-up on strength, body composition, function, and wellbeing of older adults. METHODS: Twenty-three older adults (aged 61 to 80 years) completed a 6-month supervised RT intervention applying progressive introduction of higher effort set end points. After completion of the intervention participants could choose to continue performing RT unsupervised until 6-month follow-up. RESULTS: Strength, body composition, function, and wellbeing all significantly improved over the intervention. Over the follow-up, body composition changes reverted to baseline values, strength was reduced though it remained significantly higher than baseline, and wellbeing outcomes were mostly maintained. Comparisons over the follow-up between those who did and those who did not continue with RT revealed no significant differences for changes in any outcome measure. CONCLUSIONS: Supervised RT employing progressive application of high effort set end points is well tolerated and effective in improving strength, body composition, function, and wellbeing in older adults. However, whether participants continued, or did not, with RT unsupervised at follow-up had no effect on outcomes perhaps due to reduced effort employed during unsupervised RT.

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- Zammit AR, Robitaille A, Piccinin A, Muniz-Terrera G, Hofer SM. Associations between aging-related changes in grip strength and cognitive function in older adults: A systematic review. *J Gerontol A Biol Sci Med Sci.* 2018 Mar 8. doi: 10.1093/gerona/gly046. [Epub ahead of print]

Objectives: Grip strength and cognitive function reflect upper body muscle strength and mental capacities. Cross-sectional research has suggested that in old age these two processes are moderately to highly associated, and that an underlying common cause drives this association. Our aim was to synthesize and evaluate longitudinal research addressing whether changes in grip strength are associated with changes in cognitive function in healthy older adults. Methods: We systematically reviewed English-language research investigating the longitudinal association between repeated measures of grip strength and of cognitive function in community-dwelling older adults to evaluate the extent to which the two indices decline concurrently. We used four search engines: Embase, PsychINFO, PubMed, and Web of Science. Results: Of 459 unique citations, 6 met our full criteria: 4 studies reported a longitudinal association between rates of change in grip strength and cognitive function in older adults, 2 of which reported the magnitudes of these associations as ranging from low to moderate; 2 studies reported significant cross-sectional but not longitudinal associations among rates of change. All studies concluded that cognitive function and grip strength declined, on average, with increasing age, although with little to no evidence for longitudinal associations among rates of change. Conclusions: Future research is urged to expand the study of physical and cognitive associations in old age using a within-person and multi-study integrative approach to evaluate the reliability of longitudinal results with greater emphasis on the magnitude of this association.

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Next Month's Issue:

Exercise for the Older Adult

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