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Stroke, Step Count, and Alzheimer's

Boyne P, Billinger SA, Reisman DS, Awosika OO, Buckley S, Burson J, Carl D, DeLange M, Doren S, Earnest M, Gerson M, Henry M, Horning A, Khoury JC, Kissela BM, Laughlin A, McCartney K, McQuaid T, Miller A, Moores A, Palmer JA, Sucharew H, Thompson ED, Wagner E, Ward J, Wasik EP, Whitaker AA, Wright H, Dunning K. Optimal intensity and duration of walking rehabilitation in patients with chronic stroke: a randomized clinical trial. JAMA Neurol. 2023;80(4):342–51. doi:10.1001/jamaneurol.2023.0033

Stroke survivors may experience chronic deficits in walking speed and stamina because of compromised neuromotor function and endurance capacity. Moderate-intensity walking (40%–60% heart rate reserve [HRR]) is commonly used in rehabilitation, as it is superior to lower-intensity walking for improving walking capacity. The use of sustained vigorous-intensity (>60% HRR) walking is less likely to be achieved poststroke; however, the use of high-intensity interval training (HIIT) appears to afford stroke survivors the opportunity to safely and feasibly integrate more vigorous intensities during rehabilitation. The primary intent of this study was to compare changes in the walking capacity of stroke survivors completing HIIT or moderate-intensity aerobic training (MAT).

Methods: Stroke survivors between 40 and 80 years of age with a walking speed of 1.0 m/s (2.2 mph) or slower were recruited for randomization to either the HIIT or MAT group. Training protocols included 3 × 45-min sessions per week for 12 weeks, consisting of a mix of overground (2 × 10-min bouts) and treadmill (1 × 20-min bout) walking. High-intensity interval training participants completed 30 seconds of maximum-speed walking with a 30–60-second passive recovery, at an intensity above 60% of HRR. Moderate-intensity aerobic training participants performed continuous walking starting at 40 ± 5% of HRR, progressing every 2 weeks by 5% until achieving 60% of HRR. A 3-min warmup and 2-min cooldown were performed by both groups. Walking capacity was assessed by the 6-min walk test (6MWT) at baseline and following 4, 8, and 12 weeks of training.

Results: Fifty-five participants (63 ± 10 years) were randomized to the HIIT (n = 27) or MAT (n = 28) protocol. Average session exercise intensity for HIIT participants was 75% HRR and for MAT was 59% HRR. Session step counts for HIIT and MAT were 2,847 and 3,532, respectively. Although changes in walking capacity (6MWT distance) were not different (P = 0.28) between HIIT (27 m [95% CI, 6–48 m]) and MAT (12 m [95% CI, −9 to 33 m]) following 4 weeks of training, HIIT improved significantly more compared with MAT following 8 weeks (58 m [95% CI, 39–76 m] versus 29 m [95% CI, 9–48 m], P = 0.02) and 12 weeks (71 m [95% CI, 49–94 m] versus 27 m [95% CI, 3–50 m], P = 0.005) of training.

Discussion: Moderate training intensities are commonly used in the physical rehabilitation setting to improve deficits in walking capacities in chronic stroke patients. The use of higher exercise intensities with this population shows promise, but previous studies were short in duration (4 weeks) and failed to compare with the standard use of moderate intensity. Thus, the current study sought to compare improvements in walking capacity of participants completing either a 12-week HIIT or MAT protocol, using overground and treadmill walking. Both HIIT and MAT protocols improved 6MWT distance similarly, following 4 weeks of training; however, longer into the protocol (8 and 12 weeks), greater improvements were demonstrated by HIIT participants than MAT participants. The average difference in improvement in walking distance following 8 and 12 weeks of training was 29 and 44 m, respectively. This study offers support for the integration of HIIT with chronic stroke patients when appropriate. Customizing interventions to the unique needs and abilities of each patient may offer more meaningful improvements in functional outcomes.

Stens NA, Bakker EA, Mañas A, Buffart LM, Ortega FB, Lee DC, Thompson PD, Thijssen DHJ, Eijsvogels TMH. Relationship of daily step counts to all-cause mortality and cardiovascular events. J Am Coll Cardiol. 2023;82(15):1483–94. doi:10.1016/j.jacc.2023.07.029

Walking is a common physical activity that offers numerous health benefits, leading to the widespread use of activity

trackers, offering users highly accurate data on metrics such as step counts. Considering that the well-known goal of achieving 10,000 steps became popular as the result of a marketing strategy rather than based on real-world or research evidence, establishing evidence-based step counts to address various aspects of health and wellness is important. This study sought to compile and analyze previously collected data to establish a minimum step count associated with a reduced risk of mortality and cardiovascular incidents.

Methods: Peer-reviewed prospective cohort studies published prior to October 2022 that objectively quantified step counts to examine associations with all-cause mortality or nonfatal or fatal cardiovascular disease (CVD) incidents were screened for inclusion. Both categorical dose-response analyses for low, intermediate, and high daily step counts and continuous dose-response analyses for daily step counts ranging from 1,500 to 16,000 were conducted in association with clinical outcomes.

Results: Following screening of 5,414 studies, step count data from 111,309 individuals (mean age = 62.5 ± 5.3 years) from 12 studies were analyzed. Step counts were associated with cardiac hospitalizations, all-cause mortality, and CVD incidents. The median follow-up period was 77.8 months (IQR, 71.6–82.9 months), during which 4,854 participants died. Although risk of mortality was 36% lower (aHR = 0.64 [95% CI, 0.56–0.72]) for intermediate (median = 6,000 steps/d [IQR, 5,392–6,775 steps/d]) than low (median = 3,166 steps/d [IQR, 2,375–4,191 steps/d]) daily step counts, all-cause mortality risk reduction was greatest (aHR = 0.50 [95% CI, 0.42–0.60]) for those achieving the highest (10,000 steps/d [IQR, 8,843–11,082 steps/d]) daily step counts. When compared with lower step counts, the risk of cardiovascular events was lower for both intermediate (aHR = 0.58 [95% CI, 0.46–0.73]) and high (aHR = 0.42 [95% CI, 0.33–0.53]) step counts. Continuous step-count analysis determined risk reduction for all-cause mortality, and CVD became significant at 2,517 steps/d (aHR = 0.92 [95% CI, 0.84–0.999]) and 2,735 steps/d (aHR = 0.89 [95% CI, 0.79–0.999]), respectively. Risk reductions were optimal for mortality at 8,763 steps/d (aHR = 0.40 [95% CI, 0.38–0.43]) and CVD at 7,126 steps/d (aHR = 0.49 [95% CI, 0.45–0.55]).

Discussion: Developing a large cohort of participants from 12 published papers, this study examined the dose-response relationship of daily step counts obtained from wearable activity trackers with mortality and CVD incidents. The optimal numbers of steps per day for maximizing risk reduction for all-cause mortality (60% risk reduction) and CVD (51% risk reduction) were approximately 8,800 and 7,200 steps·d^{-1}, respectively. Limited additional risk reduction was found for higher step counts, indicating most benefits are obtained at step counts below 10,000. Interestingly, the minimal thresholds to achieve significant risk reductions for all-cause mortality (8% risk reduction) and CVD (11% risk reduction) was approximately 2,500 and 2,700 steps, respectively. This study highlights the beneficial effects of physical activity on cardiovascular health and all-cause mortality, even at very low daily steps of just over 100 steps·h^{-1}. Establishing step-count goals that are grounded in research offers practitioners evidence-based recommendations for their clients, which can have a more meaningful impact on health outcomes. Rather than referencing a goal of 10,000 steps, practitioners can prescribe step goals that are reasonable and reduce risk for a deconditioned client, while working toward 8,000 or more steps. This study underscores the importance of leveraging technology, such as wearable trackers, to monitor and promote physical activity. By providing clients with real-time feedback on their activity levels, these devices have the potential to serve as effective tools for promoting behavior change and fostering a more active lifestyle.

Angiolillo A, Leccese D, Ciccotelli S, Di Cesare G, D'Elia K, Aurisano N, Matrone C, Dentizzi C, Di Costanzo A. Effects of Nordic walking in Alzheimer's disease: a single-blind randomized controlled clinical trial. Heliyon. 2023;9(5):e15865. doi:10.1016/j.heliyon.2023.e15865

Alzheimer's disease (AD), characterized by progressive cognitive decline and functional impairment, is the most common form of dementia. There is limited progress on disease-modifying therapies, and researchers are exploring alternatives to reduce patient risk, including the impact of physical activity on AD modifiable risk factors to reduce cognitive decline. Nordic walking (NW) has gained attention in recent years, as it involves the use of specifically designed poles to engage the upper body muscles, leading to a comprehensive exercise training session. Compared with walking, NW elicits higher heart rates, oxygen consumption, and energy expenditure, while also offering improved balance and reduced perceived exertion. Researchers have examined the efficacy of NW in older adults and those with chronic health conditions; however, the potential benefits to those with AD remains relatively unexplored. This study sought to examine the impact of NW on cognitive function in those with earlier stage AD.

Methods: Patients with mild to moderate AD, as determined by criteria from the National Institute on Aging and Alzheimer's Association, Mini-Mental State Examination (MMSE), and the Clinical Dementia Rating (CDR) scale, were recruited to participate in a single-blind, controlled clinical trial. Thirty participants were randomly assigned to 1 of 2 groups, experimental group (exercise group, EG, n = 15) or control group (control group, CG, n = 15). Both groups received Reality Orientation Therapy (ROT), music therapy, and motor, proprioceptive and postural rehabilitation. Additionally, the EG completed 40 min of NW training twice a week for 24 weeks. Although the primary outcome examined the 24-week change in the MMSE, a battery of neuropsychological assessments was conducted to evaluate potential changes in cognitive function over the 24-week

study. Assessments included the Frontal Assessment Battery (FAB), immediate and delayed recall for Rey's Auditory Verbal Learning Test (RAVLT), Prose Memory Test (PMT), Attentional Matrices Test (AMT), Raven's Colored Progressive Matrices (CMP), Stroop Word-Color Interference test (SWCT) for time and errors, and Copying Geometric Drawings (CGD).

Results: Analyses used data from 9 EG and 13 CG participants who completed the protocol, as 6 of the EG and 2 of the CG dropped out of the study for various reasons (health, family, or relocation). No significant differences were found in the 24-week change in MMSE (P = 0.20), immediate recall RAVLT (P = 0.77), AMT (P = 0.30), PMT (P = 0.88), CGD (P = 0.62), or SWCT errors (P = 0.11) between the EG and CG. The 24-week change demonstrated significantly improved FAB (P = 0.04), delayed recall RAVLT (P = 0.02), SWCT completion time (P = 0.006), and CPM (P = 0.02) for the EG compared with the CG.

Discussion: Unlike traditional walking, NW engages a larger muscle mass as it incorporates the use of the upper body with specially designed poles. Previous studies determined NW increases energy expenditure at the same walking pace and increases motor complexity requiring greater cognitive engagement. Despite the 24-week NW intervention failing to generate a significant difference the primary variable, MMSE, these assessment scores remained relatively stable for the EG, whereas a decline was observed in the CG. Additionally, no differences were noted for immediate recall, selective attention (AMT), or cognitive flexibility (SWCT). The NW protocol led to an improvement in executive function (FAB), visual and special reasoning (CPM), processing speed and selective attention (SWCT), and verbal episodic memory (RTVL). This study concluded that NW appears to offer some unique benefits to maintaining and potentially improving various aspects associated with cognitive function. Given the small sample size, continued research is needed to further explore NW and confirm these findings. However, because of the general health benefits of exercise and the safety of NW noted in this study, it appears that NW is a useful exercise mode in those with AD.