

Editorial

Golden years, golden sleep: the impact of physical activity on older adults' sleep quality

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Golden years, golden sleep—so the saying goes. Yet, for many, that is not always the case. As people age, they tend to spend more time in bed but experience less actual sleep [1]. Sleep becomes less efficient and more fragmented with age, as the proportion of light sleep increases while deep sleep declines [1]. Poor sleep quality, characterized by difficulty initiating and/or maintaining sleep, reduced sleep efficiency, and frequent awakenings, also evolves in complex ways as one gets older [2]. Research has consistently shown that both acute bouts of physical activity and regular physical activity improve sleep outcomes [3–5]. Further, a systematic review of 14 experimental studies reported that exercise programs significantly improved multiple sleep outcomes (e.g. Pittsburgh Sleep Quality Index [PSQI]-assessed sleep quality) among healthy older adults [6]. However, there is a lack of research examining the effectiveness of physical activity interventions on sleep quality over the longer term [6, 7]. In response to this gap in the existing evidence, Li et al. [8] conducted one of the first studies to investigate the longer-term effect of a physical activity intervention on sleep quality.

The study was a secondary analysis of a cluster randomized controlled trial. A total of 511 participants (mean age 71 ± 6 years) from eight rural villages in China were randomly assigned in a 1:1 to either an intervention group or control group. The intervention group participated in an 8-week physical activity intervention. In addition to the high follow-up rates (80.4% for the intervention group and 84.5% for the control group) of the study, the main strength related to the multilevel intervention approach, targeting individual, interpersonal, and community factors, in line with an ecological approach [9]. At the individual level, participants received personalized support through weekly phone calls, printed materials, and training sessions designed to enhance knowledge and beliefs of activity, overcome barriers to participation, and improve self-regulation and self-efficacy. The training sessions, including stretching and Tai Chi, were held at baseline, 4 weeks, and 8 weeks. On an interpersonal level, peer groups were formed, and researchers supported participants in

setting goals, reinforced through weekly phone call reminders. This approach leveraged goal setting, an established approach to helping individuals change behavior [10]. At a community level, group sharing and coaching were organized to foster mutual trust and deepen social connections as participants shared their physical activity-related experiences.

The authors examined the impact of the physical activity intervention on the PSQI global score over a 24-month follow-up period with assessments conducted at baseline, 4 weeks, 8 weeks, 6 months, 12 months, and 24 months. At baseline, the intervention group had lower levels of physical activity and higher PSQI global scores which indicate poorer sleep quality compared to the control group. The statistical analyses accounted for these baseline differences, ensuring unbiased estimates of the treatment group [11]. The intervention group showed improvements in the PSQI global score after 8 weeks, and at 6- and 12-month follow-up. Yet, only reached the minimum detectable level of one point immediately after intervention (8 weeks). This effect diminished in subsequent follow-ups, and it is unclear how meaningful these statistically significant differences are for participants' sleep quality. While the PSQI is a widely used and valid instrument, it is a recall instrument that can be influenced by participants' memory of their sleep [12–14]. Although resource-intensive, recall bias could have been mitigated by using wrist-worn accelerometers, which provide objective, device-based measures of sleep. As shown by Siu et al. [15], both Tai Chi and conventional exercise led to sustained improvements in outcomes over a 24-month follow-up period, using accelerometry to objectively assess sleep. However, it is important to note that accelerometers and subjective sleep measures capture different aspects of sleep duration [16].

The decline in intervention effects over time is common in physical activity interventions [17] and sleep hygiene education interventions [18], with the exception of Siu et al. [15] who showed maintenance of improved sleep outcomes 24 months post-physical activity intervention. This highlights the need for future interventions to focus on integrating strategies to sustain

long-term changes in sleep quality and physical activity. Further, a critical issue in addressing physical inactivity and poor sleep health at the population level is the availability of scalable intervention approaches that are effective and have broad reach [19, 20]. It remains unclear how the approach used by Li et al. [8] could be scaled and what is required to achieve this as these contextual factors were not examined. Of relevance, given the small effects on sleep quality observed by Li et al. and the typical “voltage drop” that occurs in interventions when scaled [21, 22] it may be necessary to modify the intervention prior to making it more widely available, or expect even more modest changes in sleep.

Meta-analyses of physical activity interventions observe small-to-moderate magnitude impacts of regular physical activity on sleep outcomes [4], and the modest changes in PSQI global score reported by Li et al. [8] align with this. However, there is a still a lack of clear evidence on the dose–response relationship between the duration and intensity of physical activity and sleep. A previous systematic review of exercise interventions in older adults found that those of a moderate intensity performed 3 times/week for ≥12 weeks were most likely to report significant improvements in sleep outcomes [6]. While the Li et al. [8] study did not explore different duration or intensities of physical activity, future studies should compare different doses (i.e. frequency, duration, and intensity) of physical activity to determine effectiveness using rigorous randomized control trials [3]. Further, Kredlow and colleagues [4] revealed that the positive impact of regular exercise on sleep onset latency diminishes with age. Their analysis showed a decrease of 0.15 SDs in exercise-related benefits for every 10-year increase in the average age of participants. Future research must understand the nuances of how different doses of physical activity interact with age to better tailor interventions, refining physical activity guidelines and enhancing sleep health across diverse populations.

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