Editorial

How do sleep disturbances affect driving practices in the elderly?

"...in a cohort of older drivers, we found that sleep disturbances were prevalent and associated with a decrease in driver self-ratings."

Keywords: daytime drowsiness • insomnia • older drivers • sleep apnea

In 2008, there were more than 21 million licensed drivers aged ≥70 years in the USA, a number that is sure to increase with an aging population [1]. Accordingly, safety concerns have been raised regarding older drivers, because aging is often associated with cognitive, visual and physical impairments that can lead to reductions in driving capacity, including adverse driving events [2]. Crash rates per mile driven, for example, increase for persons aged ≥70 years and fatal crashes are more likely to occur in those aged ≥80 years [1].

Sleep disturbances are prevalent in older populations [3–6]. In a large study of community-dwelling individuals aged ≥65 years [3], participants frequently reported insomnia symptoms (43%) and daytime napping (25%) [3]. Sleep disturbances due to primary sleep disorders are also prevalent in older persons, often including sleep apnea [4,5]. Nonetheless, despite sleep disturbances being established risk factors for decreased driving capacity in the general adult population [7], their contribution to the age-related decline in driving capacity has not been evaluated [8]. This may be attributable to lower rates of drowsy driving in individuals aged ≥65 years, with only 4% having dozed off while driving versus 20% of those aged 18–54 years [6].

The rate of drowsy driving in older persons is surprisingly low given their high rates of sleep disturbances [3–6,8–10]. This discordance may be explained by two scenarios. First, older people who have sleep disturbances stop driving, whereas those who continue to drive do not have sleep disturbances. Second, older drivers who have sleep disturbances may not experience drowsy driving because they change their driving practices. Prior work has shown that older persons compensate for reduced driving capacity by avoiding high-risk settings (e.g., night-time driving) or by driving shorter distances [11].

To address the above two scenarios, we have evaluated 430 older drivers (aged ≥70 years) who reported driving at least once a week [8–10]. Exclusion criteria included a Mini-Mental State Examination score <18 and distance vision <20/70 [8]. At the baseline visit, we evaluated validated sleep questionnaires – Insomnia Severity Index (ISI; ≥8 established insomnia) [12], Epworth Sleepiness Scale (ESS; ≥10 established excessive daytime sleepiness [EDS]) [13], and Sleep Apnea Clinical Score (SACS; >15 established high sleep apnea risk) [14] – as well as self-reported driving mileage and driver self-ratings (visual analog scale) [8]. Moreover, during 2 years of follow-up, we evaluated adverse driving events and changes in driving practices (driving cessation and trajectory of daily driving mileage over time) [10]. Our results were as follows:

- Sleep disturbances: insomnia was established in 26% (112 out of 430) of older drivers, while EDS was established in 19% (83 out of 430) and high sleep apnea risk in 20% (84 out of 422) [8];
- Driver self-ratings: older drivers who had EDS also had significantly lower overall and night-time driver self-ratings, versus those who did not have EDS ($p < 0.05$). Older drivers who had insomnia also had significantly lower driver self-ratings,

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but only for night-time, versus those who did not have insomnia ($p < 0.05$). Otherwise, a high sleep apnea risk was not associated with lower driver self-ratings, overall or night-time [8];

- Adverse driving events: over 2 years of follow-up, 51.4% (215 out of 418) of older drivers had at least one adverse driving event (crash, near-crash, traffic-infraction or getting lost). Nonetheless, insomnia, EDS, and high sleep apnea risk were not associated with an increased risk of having an adverse driving event [9];
- Driving practices: over 2 years of follow-up, insomnia, EDS and high sleep apnea risk did not increase the risk of driving cessation. However, regarding the trajectory of daily driving mileage, insomnia was the only sleep predictor that conferred a significant change, yielding an average decrease of 4.5 miles/day over 2 years ($p = 0.01$) – representing a 19.0% decrease in daily driving mileage relative to those without insomnia. In the insomnia model, two covariates were also associated with a decreased driving mileage: polypharmacy (≥4 medications), yielding an average decrease of 8.3 miles/day over 2 years ($p = 0.01$) – representing a 32.4% decrease in daily driving mileage relative to those with less than four medications; and each year of additional age, yielding an average decrease of 0.4 miles/day over 2 years ($p = 0.02$) [10].

Our results suggest that sleep disturbances are prevalent in older drivers and are associated with a decrease in driver self-ratings. In addition, insomnia and the covariates of polypharmacy and advancing age may alter driving practices. Otherwise, sleep disturbances were not associated with adverse driving events but, as discussed later, this may be due to age-related factors.

In our cohort of older drivers, the most prevalent sleep disturbance was insomnia [8], likely reflecting an age-related decline in sleep physiology and age-related increase in multimorbidity [4]. Our study participants had, for example, a mean age of 78.5 years and averaged 3.4 chronic conditions and 7.7 medications [10]. Importantly, insomnia was associated with a decrease in night-time driver self-ratings and with a decrease in daily driving mileage [8,10]. The mechanisms that underlie these associations may relate to the adverse effects of nonrestorative sleep (insomnia) on daytime function, including fatigability and impaired cognition, and these typically worsen over the course of the day [15]. Moreover, in the insomnia model, polypharmacy and advancing age were associated with a decrease in daily driving mileage [10]. It is well established that medications and aging have an adverse effect on neurocognitive and physical function, and these, in turn, may lead to insomnia and a reduced driving capacity [2,4].

Given the above discussion, we posit that insomnia treatment and reduced polypharmacy may improve driving capacity in older persons. This approach could also mitigate the social isolation and depressive symptoms that complicate insomnia or reduced driving capacity [4,16,17]. Regarding insomnia therapy, the emphasis is on cognitive behavioral interventions, rather than hypnotics [4,18,19]. Regarding polypharmacy, effective medication reduction may be achieved by promoting healthier lifestyles, as in increased physical activity and socialization, and improved dietary habits [4].

Otherwise, the benefits of insomnia therapy on driving safety may be limited. In the same cohort of older drivers, we found that insomnia was not associated with adverse driving events [9]. This lack of association may reflect a reduced exposure to driving risk that is unique to older drivers [8–10]. For example, other investigators have shown that people aged 30–34 years drive 42.3 miles/day, whereas those aged 75–79 years drive only 13.8 miles/day. Our cohort of older drivers similarly reported shorter distances, with 87% driving <20 miles/day (i.e., sleep-related driver fatigue is more common with longer driving distances). The exposure to driving risk may have been further reduced by avoiding night-time driving. In our cohort of older drivers, nearly a third avoided night-time driving.

Although established as risk factors for reduced driving capacity in the general adult population [7], we found that EDS and high sleep apnea risk were not associated with daily driving mileage or adverse driving events in our cohort of older drivers [9,10]. Age-related factors may be responsible. For example, using the same diagnostic threshold (ESS ≥10), a national survey of persons aged 18–29 years reported a prevalence of EDS (41.7%) that was higher than in our cohort of older drivers (19.0%) [20]. These age-related differences may arise for three reasons [8–10]. First, chronic sleep loss and the consequent reduction in performance across wakefulness is more prevalent and severe in younger than older people. Second, the importance of sleep apnea diminishes with age, evidenced by more severe hypoxemia in younger than older persons, and by an increased risk of incident coronary heart disease in middle age but not old age. Third, as discussed earlier, younger persons drive longer distances than older persons, and longer distances are more likely to lead to drowsy driving. Nonetheless, it is important to note that a medical evaluation should be considered in older persons who report EDS, as this may be also associated with adverse health outcomes that are unrelated to sleep apnea or a reduced driving capacity [4].

The results of our work require confirmation, as there were potential limitations in study design [8–10]. First, sleep instruments were based on self-report. Because aging is associated with reduced symptom-awareness, the ISI and ESS may be limited as indicators of severe sleep disturbances in older persons. Prior work has also shown that self-reported snoring and apneas have diminished predictive capacity for sleep apnea in older persons, thereby limiting the accuracy of the SACS instrument. Second, our cohort was predominantly male (85%). It has been shown that older women are more likely than older men to have insomnia and self-regulate driving. Third, a larger study population may be required to fully evaluate significant differences in driving outcomes. Last, because our follow-up was limited to 2 years, this may have attenuated the associations between sleep disturbances and driving outcomes. Hence, future studies will need to enroll a larger sample of older persons, represent women more fully, objectively evaluate sleep disturbances and driver performance, and provide longer follow-up.

In conclusion, in a cohort of older drivers, we found that sleep disturbances were prevalent and associated with a decrease in driver self-ratings [8,9]. Insomnia, in particular, including the covariate of polypharmacy, was also found to decrease daily driving mileage [10], an outcome in older persons that often occurs in response to a reduced driving capacity [11]. Hence, we posit that sleep disturbances may reduce driving capacity in older persons, and that this adverse effect is potentially managed with insomnia-based cognitive-behavioral therapy and medication reduction.

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