

## Sleep spindle characteristics and arousability from nighttime transportation noise exposure in healthy young and older individuals

Franziska Rudzik, Laurie Thiesse, Reto Pieren, Jean Marc Wunderli, Mark Brink, Maria Foraster, Harris Héritier, Ikenna C Eze, Corrado Garbazza, Danielle Vienneau ... [Show more](#)

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### Abstract

#### Study Objectives

Nighttime transportation noise elicits awakenings, sleep-stage changes, and electroencephalographic (EEG) arousals. Here, we investigated the potential sleep-protective role of sleep spindles on noise-induced sleep alterations.

#### Methods

Twenty-six young (19–33 years, 12 women) and 18 older (52–70 years, 9 women) healthy volunteers underwent a repeated measures polysomnographic 6-day laboratory study. Participants spent one noise-free baseline night, followed by four transportation noise-exposure nights (road traffic or railway noise; continuous or intermittent: average sound levels of 45 dB, maximum sound levels of 50–62 dB), and one noise-free recovery night. Sleep stages were scored manually and fast sleep spindle characteristics were quantified automatically using an individual band-pass filtering approach.

#### Results

Nighttime exposure to transportation noise significantly increased sleep EEG arousal indices. Sleep structure and continuity were not differentially affected by noise exposure in individuals with a low versus a high spindle rate. Spindle rates showed an age-related decline along with more noise-induced sleep alterations. All-night spindle rates did not predict EEG arousal or awakening probability from single railway noise events. Spindle characteristics were affected in noise-exposure nights compared to noise-free nights: we observed a reduction of the spindle amplitude in both age groups and of the spindle rate in the older group.

#### Conclusions

We have evidence that spindle rate is more likely to represent a trait phenomenon, which does not seem to play a sleep-protective role in nighttime transportation noise-induced sleep disruptions. However, the marked reduction in spindle amplitude is most likely a sensitive index for noise-induced sleep alterations.

[road traffic noise](#), [railway noise](#), [arousal](#), [awakening](#), [EEG](#), [automatic detection](#), [intermittency ratio](#)

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[noise, transportation](#)

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