WHO Environmental Noise Guidelines for the European Region: A systematic review on environmental noise and effects on sleep

Sarah McGuire¹, Mathias Basner¹

¹ Division of Sleep and Chronobiology, Department of Psychiatry, University of Pennsylvania Perelman School of Medicine, Philadelphia, PA, USA

Corresponding author’s e-mail address: basner@upenn.edu

ABSTRACT

To evaluate the strength of evidence on the effects of environmental noise on sleep, a systematic literature review was conducted. A meta-analysis of surveys and a pooled analysis of polysomnographic studies on the effects of transportation noise on sleep were conducted. A narrative review was conducted for motility, cardiac and blood pressure outcomes, and children’s sleep. The effect of wind turbine and hospital noise on sleep was also assessed.

The unadjusted odds ratio for the percent highly sleep disturbed for a 10 dB increase in $L_{\text{night}}$ was significant for aircraft (1.936; 95% CI 1.608-2.332), road (2.126; 95%CI 1.820-2.483), and rail (3.058; 95%CI 2.378-3.933) noise. The unadjusted odds ratio for the probability of awakening for a 10 dB increase in the indoor $L_{\text{max}}$ was significant for aircraft (1.351; 95%CI 1.218-1.499), road (1.360; 95%CI 1.192-1.550), and rail (1.354; 95% CI 1.209-1.515) noise.

Based on the evidence, transportation noise affects objectively measured sleep physiology and subjectively assessed sleep disturbance. For other outcome measures and noise sources evidence was conflicting or only emerging.

Acknowledgements

We would like to thank Mark Brink, Thu Lan Nguyen, Dirk Schreckenberg, Abigail Bristow, Takashi Yano, Jiyoung Hong, Jaana Halonen, Gordana Ristovska, Martin Röösli, Lex Brown, Gunn Marit Aasvang, and Theo Bodin, who graciously shared de-identified self-reported sleep data from their studies. We would also like to thank Uwe Müller and Daniel Aeschbach, German Aerospace Center, for sharing the polysomnography data.