Investigating the impact of nocturnal aircraft noise on children's sleep, cognitive performance and annoyance: The MIDAS-study

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EXTENDED ABSTRACT

Disturbances of sleep are the most serious effect of nocturnal traffic noise exposure. These disturbances can be manifested primarily by awakening reactions, changes in the sleep depth and sleep continuity. As secondary reactions, subjective sleep quality, well-being and cognitive performance can be impaired and noise annoyance may result. The acute effects of aircraft noise on sleep and related subjective variables have mostly been investigated in healthy adults so far. In the recent time, noise effects research more and more focuses on so-called vulnerable groups, i.e. the part of the population who expectedly shows particularly susceptibility to noise impacts. These vulnerable groups comprise elderly and sick people, shift worker, and above all children. Restorative sleep is vital in physiological and cognitive development of children. However, studies on the effects of transportation noise on the sleep of children using polysomnography are rare both for the field and the laboratory setting. An investigation seemed particularly necessary due to the differences of sleep structure and sleep behaviour of adults.

In an ongoing field study, the German Aerospace Center (DLR) investigates the acute impact of aircraft noise on sleep and related psychological reactions of 50 children aged 8 to 10 years. The study is conducted in the vicinity of Cologne/Bonn Airport which is an important German cargo hub operating 24 hours a day with a busy period between 11 p.m. and 5 a.m.

Children are examined polysomnographically (via EEG, EMG, EOG, ECG, and pulse oximetry) during four consecutive nights. The first night serves as adaptation to the measuring devices. During all nights, aircraft and ambient sounds and sound pressure levels are recorded with one class-1 sound level meter each inside the bedroom next to the children's ear and another in front of the bedroom window. In the morning 30 min after awakening, participants retrospectively rate their sleep quality, problems falling asleep, acute fatigue, and short-term annoyance via five-point scales with verbal and graphical labels presented on a notebook. Subsequently, cognitive performance is measured using age-appropriate computer-assisted tests (psychomotor vigilance task, distractibility test). Long-term annoyance and disturbance, and relevant psychological moderator variables (e.g., noise sensitivity, attitudes

towards air traffic) are assessed via computer-assisted personal interviews. In parallel, a corresponding survey is administered to the parents of the participating children. Both survey versions mostly apply standardized semantic five-point response scales and in addition several more in-depth open questions. Children receive an extensive explanation of the scales.

Participants are selected in a multi-stage selection process. This process comprises questionnaires screening for physical, psychological, and sleep disorders as well as an audiometric screening testing for a normal hearing threshold. In one night prior to the study, nocturnal noise exposure is recorded to ensure that the children are primarily exposed to aircraft noise with only minor exposure to other (traffic) noise sources. Both parents and children are required to sign informed consent and are reimbursed for participation. The study protocol was approved by the ethics board of the Chamber of Physicians North Rhine.

The field study will continue until October 2017. Up to now, 30 children have completed the study protocol. There have been no early study terminations so far. Both children and parents have rated the study procedure and methodology positively: Strain due to the study protocol has been considered as small and the questionnaires and performance tests have been regarded as appropriate.