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Road traffic noise-induced sleep disturbances: a comparison between laboratory and field settings

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Abstract

Due to the ongoing discussion about the relevance of sleep studies performed in the laboratory, the aim of this study was to assess the effects of road traffic noise exposure on sleep in laboratory and in field settings. Eighteen healthy young subjects participated in the study. They were exposed to noise from road traffic in the laboratory and exposed to the same recorded traffic noise exposure in their own homes. Their sleep was evaluated with wrist actigraphs and questionnaires on sleep.

No significant increase in effects of noise on sleep in the laboratory was found. The results indicate that laboratory experiments do not exaggerate effects of noise on sleep.

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1. Introduction

Disturbance of sleep and restoration is one of the most serious effects of road traffic noise. Field studies and laboratory experiments on noise-induced sleep disturbance show differing results. In a paper which reanalyses earlier studies, large discrepancies were found between laboratory experiments and field settings regarding the variables analysed; arousals or awakenings and change to a lighter stage of sleep. The results show a higher extent of sleep disturbance in the

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laboratory and the relevance of the results from laboratory experiments on sleep has been called into question [1].

The aims of this study were to assess the effects on sleep of different types of noise exposures (road traffic, ventilation and a combination of noise from road traffic and ventilation) and compare the effects in laboratory and in field settings. This paper presents results from the part of the study concerning road traffic noise exposure on sleep in laboratory and in field settings. The complete results have been previously presented in full in another issue of Journal of Sound and Vibration [2].

Eighteen healthy young subjects who lived in rather quiet residential areas participated in the study. They were exposed to noise from road traffic in the laboratory and exposed to the same recorded traffic noise exposure in their own homes. After habituation nights they were exposed to one night with road traffic noise in the laboratory and three nights at home. Their sleep was evaluated with wrist actigraphs and questionnaires on sleep and mood. The road traffic was recorded outdoors beside a motorway and mixed to consist of a total of 64 passing vehicles with a maximum level of car passages of $L_{Amax} 55 \pm 3$ dB. The background sound level of the continuous traffic noise was $L_{Aeq, 23-07h} 32$ dB and the total noise level was $L_{Aeq, 23-07h} 39$ dB.

2. Results

Results as mean values and standard deviations from the nights with traffic noise exposure, assessed by questionnaires and by actigraphy, in the laboratory and at home are shown in Table 1.

There were no significant differences in reported sleep quality between laboratory and field settings. The only significant difference found was for percent sleep (percent minutes scored as sleep) which was slightly higher in the laboratory than at home.

Table 1

Results from reported sleep and sleep quality assessed by actigraphy for road traffic noise exposure in the home and in the laboratory

	Home		Laboratory	
	Mean	SD	Mean	SD
<i>Reported sleep quality</i>				
Awakenings, number	1.6	1.0	1.4	1.3
Sleep quality (0–100) ^a	62	18	58	23
Movements (0–100) ^b	42	16	39	22
Tired-alert morning after (0–100) ^c	44	18	43	22
<i>Actigraph data</i>				
Activity mean, score	7.1	3.9	6.5	3.9
% Sleep	92	7.1	94*	7.5
Wake episodes, number	9.1	7.8	7.2	5.3

^aHigher averages indicates higher sleep quality.

^bHigher averages indicates more movements.

^cHigher averages indicates more alert in the morning.

* $p < 0.05$.

3. Conclusions

The results obtained by questionnaires and wrist actigraphy indicate that laboratory experiments do not exaggerate effects of noise on sleep. However, new studies on sleep are needed where subjects living in a relatively noisy home environment participate. In contrast to this study, they are used to sleeping with road traffic noise exposure and will be exposed to the same noise in the laboratory as in their home environment.

References

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