inter•noise 96
25th Anniversary Congress – Liverpool

INCE: 62.2

ROAD TRAFFIC NOISE, SELF MEDICATION, AND PRESCRIPTIONS: A COMMUNITY STUDY

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1. INTRODUCTION

Self-medication, seeking doctor's advice, and prescription of medicines are seen as a complex behaviour pattern that is believed to be guided predominantly by the perception of symptoms experienced. However, the majority of symptoms is not immediately reported to a medical practitioner, but rather a 'wait and see' strategy is adopted including self-treatment or doing nothing. Thus, regular prescriptions must be seen as an endpoint of a complex process indicating persisting health problems, but also reflecting access to health care, and physicians' behaviour. On the other hand, self-medication is considered to be a more direct indicator of symptoms of distress because of the individuals' own control over the uptake.

One of the potential external sources of distress in everyday life is chronic environmental noise exposure, affecting sleep, mood, cardiovascular functioning, and other body systems. It is therefore reasonable to hypothesize an increase in medication use in areas of higher levels of exposure. However, relatively few studies have tried to evaluate this link using various study and questionnaire designs. The evidence for a valid relationship is mixed.

In the Swiss airport study, Graf et al. [1] reported a higher proportion of drug uptake in areas with high aircraft noise. The direct, noise-worded questions they used (e.g. 'Has aircraft noise led you to take ..') are suspicious of a potentially biased response. Relster [2] found more consultations for psychological problems, and greater use of tranquillizers in the area with high levels of road traffic noise in Copenhagen. The differences, however, were restricted to subjects of lower socioeconomic status. Knipschild and Oudshoorn [3] retrospectively analysed the drug consumption in 2 villages based on pharmacist's purchase data. One village was subsequently exposed to increasing air traffic, while the

second community with low aircraft exposure served as control. They reported the purchase of sleeping pills, sedatives, antacids, cardiovascular, and antihypertensive drugs to have increased in the aircraft noise exposed community over time, while no clear change was observed in the control village. Langdon and Buller [4] concluded from a road traffic survey that relatively few people resorted to sleep inducing drugs as a counter-strategy to noise in spite of a substantial proportion of sleep disturbed. In the Bonn traffic noise study, a higher proportion of subjects reporting antihypertensive treatment was found in the noisy area. No differences were seen for psychoactive drugs or analgetics [5]. Summarizing results from four larger urban road traffic surveys Nemecek et al. [6] did find slight increases of sleeping pill and ear plug use above 55 dB(A),Leq_{22-6}.
Detailed studies have been conducted around London airport. Watkins et al. [7] were not able to demonstrate any consistent relationship of measured noise (NNI) with various indicators of drug or health care use. Overall drug use and uptake of psychotropic drugs were, however, significantly related to annoyance ratings. Schulze et al. [8], monotoring prescriptions and consultations of general practitioners over a one year period, have found a higher rate of prescriptions for analgetics, sleeping pills, cardiovascular, and antihypertensive drugs in the area exposed to high night levels (>72 dB(A),Leq_{22-6}) of road traffic noise. Studying urban road traffic, Lambert et al. [9] reported increases of sleeping pill, tranquillizer, and stomach medication uptake above 60 dB(A),Leq_{8-20}. Heart medications increased around 70 dB(A),Leq_{8-20}. In a small study, Griefahn et al. [10] did not see a relation of sleeping pill use with noise levels, but rather some sensitive subgroups (women, elderly, low SES) tended to cope with noise induced sleep disturbance by drug use. Likewise, Altena et al. did not find an increased uptake of sleeping pills or tranquillizers in noisy areas, covering road and air traffic [11].
On the other hand, Öhrström saw an overall higher proportion of sleeping pill and ear plug use in the noisy road traffic area [12].
Nivison and Endresen have found prescription drugs to be associated with noise sensitivity, while over-the-counter drug use was related to annoyance. However, the associations were only significant in women and no relationship was seen with measured road traffic noise levels [13].
The aim of this investigation is to use both subjective (annoyance, noise sensitivity) and objective indicators (noise levels) to analyse the association between road traffic noise exposure and various types of medication use suggested to be related to noise in earlier studies.

2. METHODS

An epidemiological survey was carried out in 5 rural communities along two major through-traffic routes in the Austrian part of the Alps [14]. Residents of this area have experienced an increasing traffic load (tripling

since the mid-1970s), a significant proportion of it being trucks (20 %). During the night the proportion of trucks has risen to around 50 %.
1989 citizens, aged 25 to 65, responded to an interviewer administered questionnaire. It covered sociodemographic and life style information as well as experienced annoyance, attitudes, behavioral changes, general health and drug consumption (62 % participation). A recruitment analysis revealed an even participation proportion from all noise classes and therefore a sampling bias due to experienced exposure could be ruled out. Individual noise exposure assignments (5 dB classes, ranging from 40 - 75 dB(A),Leq) were based on standardized day/night recordings, combining information from long- and shortterm measurements.
Annoyance was measured on a standard rating scale with four grades (not at all, a little,| moderately, strongly). Noise sensitivity was rated on a scale with six grades (not at all, a little, moderately, considerable | strongly, very strongly). German wording was taken according to a semantic study on magnitude rating carried out by Rohrman [15].
Current drug use was measured on a five grade frequency response scale (< once/month, once/month, once/fortnight,| once/week, daily).
For most analyses ordered response categories were dichotomized (| is indicating the cutpoint) to guarantee reasonable sample size and valid exposure or outcome distribution. Therefore, apart from basic Mantel-Haenszel techniques, analytic statistics rely on multiple logistic regression of dichotomized drug use frequencies on noise exposure above or below 55 dB(A),Leq, (reflecting the WHO recommendation for residential areas). The reported effect measure - the odds ratio - provides a simple estimate of the relative strength of the association between predictor and outcome variables. Odds ratios with 95 %-confidence intervals above or below 1 indicate a significantly positive or negative association between outcome and exposure variable of interest.

3. RESULTS

The respondents (Tab. 1) exposed to noise levels above 55 dB,A were comparable in many aspects, except, subjects were more likely to have a rented home and were on average slightly younger (1.2 yrs). The exposed did not differ in potential confounding factors, such as educational level, household size, duration of living, commuting, shiftwork, work satisfaction, smoking, drinking, physical activity and social support.
Medication use showed varying associations with noise level, annoyance, and noise sensitivity (Tab. 2). Prescriptions were strongly associated with all indicators, but ,surprisingly, strongest with noise level. Use of sleeping pills was linked with noise level and sensitivity, but failed to reach significance with annoyance. Tranquillizer use was only related to sensitivity. On the other hand, vitamin use showed a similar weak association with all indicators. Use of analgesics and antacids were significantly linked with sensitivity and annoyance, but not with noise level.

Table 1. Demographic and life style characteristics by traffic noise exposure

Variable	Noise Exposure < 55 dB,A %	> 55 db,A %	Statistic Odds Ratio* (95% CI)
Age > 45 yrs	47.1	41.1	0.78 (0.65 - 0.95)
Female sex	55.7	54.8	1.01 (0.83 - 1.22)
Higher education	13.7	12.8	0.93 (0.70 - 1.23)
Household size > 5	23.8	22.4	0.93 (0.74 - 1.16)
Rented home	11.2	20.0	2.00 (1.55 - 2.58)
Living here since birth	39.6	38.0	0.94 (0.77 - 1.14)
Not commuting	56.2	53.7	0.90 (0.75 - 1.09)
Work noise exposure	39.7	41.2	1.06 (0.88 - 1.29)
Night shiftwork	22.5	24.0	1.09 (0.87 - 1.37)
High work satisfaction	52.5	52.1	0.99 (0.82 - 1.20)
Current smoking	26.2	29.2	1.16 (0.94 - 1.44)
Drinking alcohol: regular	57.1	55.2	0.93 (0.77 - 1.12)
Physical activity: regular	42.5	41.7	0.97 (0.80 - 1.18)
Social support: friends	33.4	33.9	1.02 (0.84 - 1.25)
Social support: relatives	47.4	49.5	1.09 (0.90 - 1.32)

* Prevalence odds ratio with 95 % confidence intervals

with noise level, perceived annoyance, and rated noise sensitivity

Self-medication and prescriptions	Noise Level > 55 dB,A OR* (95% CI)	Noise Annoyance moderate/strong OR* (95% CI)	Noise Sensitivity strong/very strong OR* (95% CI)
Prescriptions	3.65 (2.13-6.26)	2.15 (1.24-3.70)	2.58 (1.50-4.44)
Sleeping pills	2.22 (1.13-4.38)	1.32 (0.68-2.59)	2.51 (1.25-5.00)
Vitamins	1.54 (1.03-2.32)	1.88 (1.25-2.82)	1.63 (1.09-2.44)
Pain killer	1.27 (0.89-1.83)	1.49 (1.05-2.12)	1.76 (1.24-2.51)
Tranquillizer	1.13 (0.60-2.13)	1.72 (0.94-3.13)	2.14 (1.17-3.93)
Antacids	0.85 (0.47-1.57)	2.11 (1.19-3.74)	1.78 (1.02-3.10)

* Prevalence odds ratios with 95 % confidence intervals, adjusted for age, sex, education

4. DISCUSSION

Multiple logistic regression analyses suggest a stable association of noise levels above 55 dB(A),Leq, with prescribed drugs in rural, residential areas. This result is in agreement with earlier studies [1,3,5,6,8,9,12], although the moderate level at which the effects occur is somewhat surprising. Adaptation level theory and research on non-acoustical factors can provide a reasonable explanation for this fact [16,17]. Over 20 years, the acoustical environment of the study area has changed substantially after a new highway was opened. Topographic features (hilly sites) made classic noise abatement measures (barriers) difficult and the single unit and detached houses did not have a quieter side. Most respondents felt surrounded by noise. The increase in the proportion of truck traffic during night poses a special load to these communities, where the usual background noise level during night is below 35 dB(A),Leq. In addition, some villages experienced a doubling of the local traffic passing the center. This complex and significant change to the area may have exceeded the adaptability of a significant proportion of the population due to the mentioned single factors.

Noise sensitivity shows significant links with all types of medication. This finding supports the view of noise sensitivity being an indicator of general susceptibility regardless of noise [18], and explains why some studies have found a link only to noise sensitivity but not with noise level [7,10,13]. On the other hand, the annoyance-medication relationship slightly deviated in that use of psychotropic drugs (hypnotics and tranquillizer) was not significantly related. This fact is compatible with a recent analysis [19] that showed differences in coping behaviour between annoyed and sensitive subjects. People rating themselves annoyed are more likely to close windows, having installed double glazing, and moved sleeping room. Therefore, it is reasonable to hypothesize that the active coping behaviour has reduced the actual noise exposure for the annoyed indoors and saved them from taking more sleeping pills or tranquillizers than usual. The reported lower prevalence of sleep disturbance among the annoyed is another indication for this idea. However, the strong association with the use of antacids shows that their style of coping may have other costs to the body as well.

The results were adjusted for age, sex, and education, the most important varying determinants of drug use apart from the underlying chronic morbidity of an area [20]. Further adjustment for noise sensitivity did not alter the reported relationship between medication usage and noise level. Detailed confounder analysis (Tab. 1) revealed no evidence of an unequal distribution for relevant determinants of background morbidity that could be responsible for a substantial bias. Likewise, selective migration is not an issue in this study area with 40 % of respondents living since birth, and with 80 % of respondents living more than 10 years in this area. Most of these methodologic criteria were not met in earlier studies. However, stronger evidence would have been gained from a longitudinal design with general practitioners' prescription records.

5. CONCLUSION

This study provides support to the evidence that road traffic noise exposure above 55 dB(A),Leq with a high proportion of truck traffic during night in rural, residential areas can give rise to both, self-medication and prescriptions. However, generalization of the results to other areas, where the traffic history, acoustic, topographic, and other environmental characteristics differ essentially, is not advisable.

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