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Rail exposure and the prescription of medicines

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ABSTRACT

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' behavior. Whether transportation noise exposure may be associated with the prescription of medicines is still subject of discussion and the number of available papers on this subject is limited. Most papers deal with road or aircraft noise.

This study used social security data to assess whether road or rail exposure is associated with the prescription of medicines. For this purpose the population (N=28025) of a contiguous area was sampled by means of a GIS data base on the distance to the transportation source (highway, main road, local roads, rail, mixed exposure). In a first step the age-stratified medication use of the various transportation samples was compared against the prevalence of medicine use of the population living outside the chosen distances to the transportation sources („the unexposed").

Prescription of medicines were mainly associated with exposure to the rail track, while local roads showed no increased risks. Medications against depression, antacids, antiallergics were among the prescriptions most consistently associated with higher odds ratios. Furthermore, the risk estimates increased with increasing age – except for antiallergics, where also the age group below 15 years showed a significant association.

1 INTRODUCTION

The environmental burden of disease received increasing attention during the last decade [2],[19],[16]. In the Netherland and Switzerland this type of noise health impact assessment has already found its way into standard health reporting [7],[13],[4]. Adequate and reliable health information is not easily available.

Register data of prescription of medicines would be a good source, however, the access to these databases is usually limited due to data protection issues. Therefore, only a limited number of noise impact studies used this data source [6], [21]. Most medication studies in the noise field used survey information based on self reports [12],[17],[9],[22],[14],[8],[18],[15],[20],[11],[10],[1],[5]. The exposure in most of these studies was noise from roads, followed by aircraft. To our knowledge, no published study did report on rail noise exposure.

Most consistently, higher rates were found with sedatives/hypnotics or use of cardiovascular medications, when noise levels were higher. However, some studies did report stronger associations with self-medication or OTC-drug use [10],[5].

We had the opportunity to gain access (after a long process) to regional social security data within the framework of an Environmental health impact assessment (EHIA).

2 METHODS

2.1 Area and Population

The study area was the Wipp-valley north of the Brenner Pass in Austria. This narrow valley is the major alpine transit-route linking North and South-Europe. Highway, rail track and main road mostly run close in parallel with changing combination of source exposure. Road traffic exposure has doubled, fright rail traffic increased mainly during night.

The medication data set was available for the full area. It consisted of more than 7000 addresses with 28000 persons overall (N=28025). Only age was available in addition to the medication information.

2.2 Exposure assessment

As noise mapping was not available for the whole area we used an alternative surrogate exposure assessment. The residential addresses were assigned to a dominant traffic source based on distance. The traffic sources considered comprised highway, main road, lower level roads, rail and combined exposure. The rest of the addresses served as reference population. Varying distance samplings were considered for the various traffic sources (Table 1). The sampling distances were based on the literature and should provide additional help for the interpretation of the results. The assignment to a group was exclusively. Only 5% of addresses could not be assigned with certainty and were therefore excluded.

Tabelle 1: Criteria for the assignment of an address to a traffic source:

Group	Sampling 1	Sampling 2	Sampling 3
Highway (AB)	Distance to AB < 100m	Distance to AB < 150m	Distance to AB < 200m
Main road (BB)	Distance to BB < 50m	Distance to BB < 50m	Distance to BB < 50m
Lower level roads (BL)	Distance to BL < 50m	Distance to BL < 50m	Distance to BL < 50m
Railway (EB)	Distance to EB < 50m	Distance to EB < 150m	Distance to EB < 200m
Combined sources	In more than one of the above groups	In more than one of the above groups	In more than one of the above groups
Reference	In none of the above groups	In none of the above groups	In none of the above groups

2.3 Statistics

First, the medication prevalence proportion was calculated for each group as the ratio of the number of persons with medication to the overall number of all persons with a unique address assignment in the whole area. For reasons of statistical power smaller medication group were lumped together based on subject matter. This medication prevalence proportion was calculated separately for each of 5 age groups (0-14, 15-29, 30-49, 50-69, 70+). Secondly, an risk indicator (prevalence odds ratio) was calculated as the ration of the number of persons with medication in the respective exposure group against the reference group living outside the distance definitions of the three samplings. The odds ratio and the respective 95% confidence intervals were calculated with Epi-Info (CDC 2000).

3 RESULTS

3.1 Prevalence of prescriptions in the study area

The most prevalent medications turned out to be antacids, followed by antiallergic medication, antidepressants, and asthma drugs.

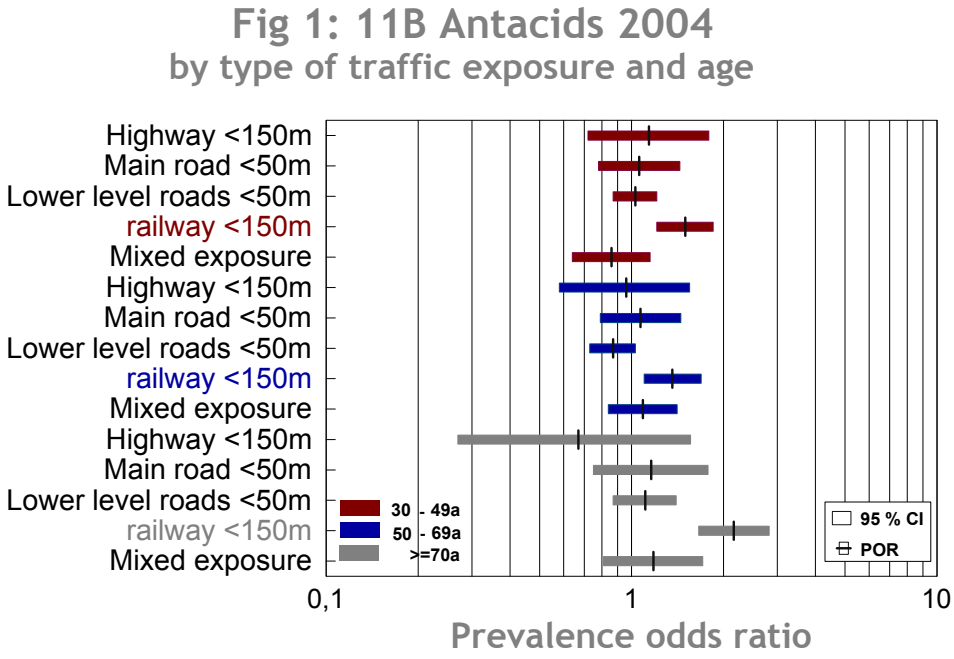
Table 1: Overall prevalence of prescriptions

SS-list Nr.	Type of medication	N in 2004	% of population
Ind. 11B	Antacids	3411	10.90
Ind. 24C+H+25B+28	Antiallergic medication	1733	5.40
Ind. 10B	Antidepressants	1413	4.46
Ind. 27	Asthma medication	1399	4.42
Ind. 20B	Lipid lowering drugs	853	2.90
Ind. 19B+E+F	Antihypertensives*	728	2.34
Ind. 25B	ENT-drugs (Rhinologica)	678	2.09
Ind. 08+09+10D	Hypnotics, Sedatives, Tranquilizer	596	1.81
Ind. 18C	Coronary therapeutics	291	0.90

* ACE-blocker and diuretics not included

3.2 Antacids

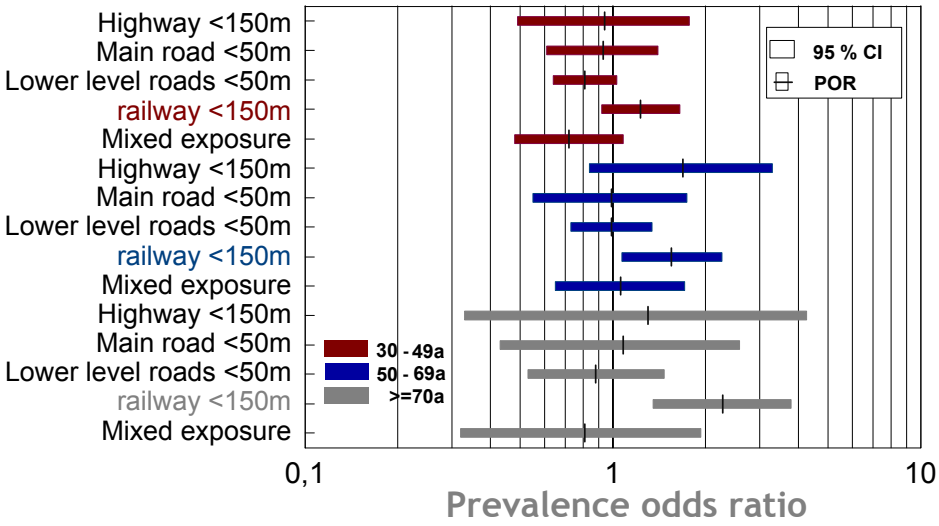
Due to the high prevalence of antacid consumption the pattern of association with the rail track is very consistent. Both, in sampling 2 (eb 150) and sampling 3 (eb 200) a continuously increasing, significant OR can be observed from age 30 on throughout to the highest age group (only sampling 2 shown in Fig 1).



3.3 Antiallergic medication

Different from the other medications, antiallergic medications show a significant association with the rail track (eb 150+200) already in the youngest age group (not shown here: OR=1.46, CI95 1.00-2.10). However, also above the age of 50 a significant association re-occurs and gets strongest in the highest age group (OR=2.27, CI95 1.35-3.79). In sampling 3 (eb 200) the youngest group mimics the result but also the middle age group (age 30-50) just reaches significance (OR=1.35, CI95 1.00-1.73). (only sampling 2 shown in Fig 2).

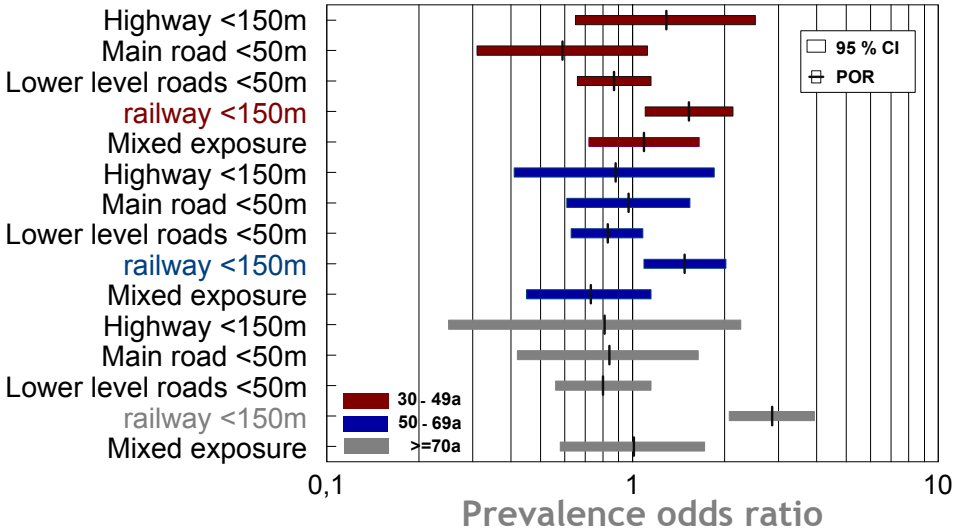
Fig 2: Antiallergic medication: Ind. 24C+H+25B+28
by type of traffic exposure and age



3.4 Antidepressive medication

In sampling 2 we see a continuously increasing and significant OR from age 30 to the highest age group in residents living within 150m of the rail track (eb 150). A nearly identical result can be observed in sampling 3 (eb 200m). (only sampling 2 shown in Fig 3).

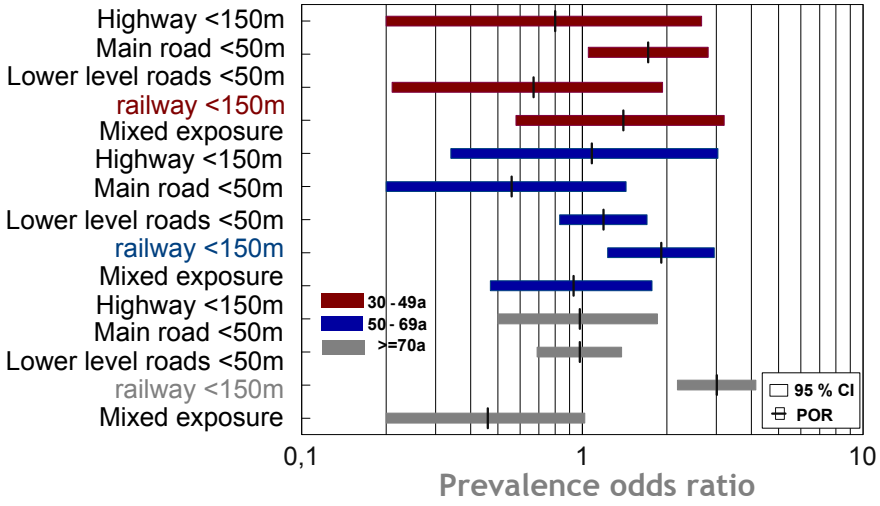
Fig 3: 10B Antidepressants 2004
by type of traffic exposure and age



3.5 Sedatives, Hypnotics, Tranquillizer

In this group a significant link with rail exposure is evident above age 50 and is again strongest in the highest age group (OR=3.01, CI95 2.18-4.15). Here, also a significant association is observed with main road exposure, but only in age group 30-49.

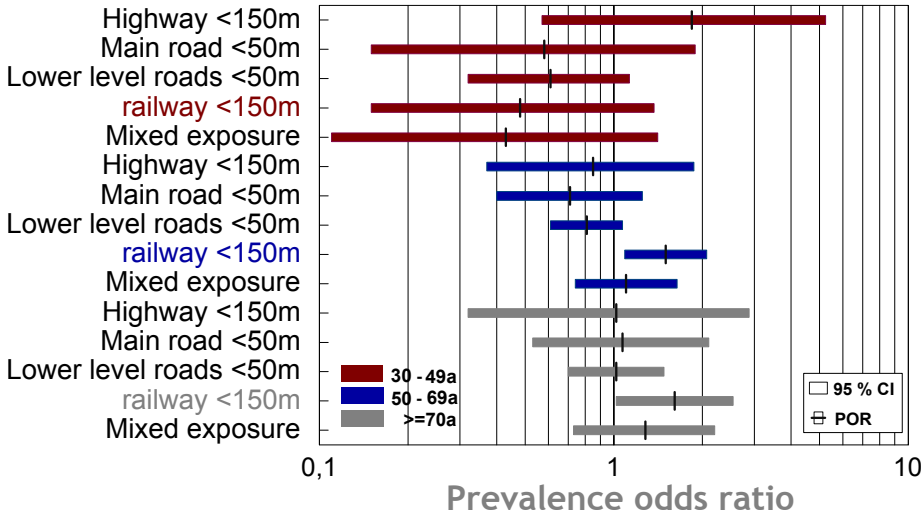
Fig 4: 08 Sedativa / 09 Hypnotika / 10D Tranquilizer
by type of traffic exposure and age



3.6 Lipid lowering drugs

Although the risk estimates for rail exposure are smaller with this group of drugs, the two older age groups (50-69 and above 70) show a significant association, which is resembled also in sampling 3 (only sampling 2 shown in Fig 5).

Fig 5: 20B Lipid lowering drugs 2004
by type of traffic exposure and age



3.7 Other drugs

Among other prevalent drugs, analyses revealed significant associations with rail exposure only in the oldest group (>70). Results are similar up to 200 m (sampling 3).

Asthma medication: OR=2.42, CI95 1.55-3.77
Coronary therapeutics: OR=2.29, CI95 1.48-3.53
Antihypertensives: OR=2.09, CI95 1.36-3.21

4 DISCUSSION

The consistent association with rail exposure must be seen as surprising in the light of the literature. The high noise exposure during night (nearly 3 dB higher than day exposure) due to freight trains may be a likely culprit. The non-association with the highway cannot be seen as definite result: as the sample of persons living close enough is not large enough and lives often below the level of the highway, where noise levels are lower. Moreover, a night ban on loud trucks is in effect and has reduced the number of trucks in this area now for 15 years. A definite non-association can be observed with lower level roads, where the lowest proportion of heavy trucks can be observed. However, the results of the main road sample should not be taken as definitive. The exposure to trucks is higher, but sample sizes are mostly too small to be trusted.

What may be surprising is the consistent non-association of the mixed exposure group. No convincing explanation is ready at hand. Masking may play a role during daytime but not during night. Better shielding from buildings in these more densely populated areas of mixed exposure is more likely. More exposure analyses are necessary.

An interesting design feature of the traffic exposure pattern in this area is the fact of lower air pollution levels as you would expect from the traffic counts. This “low pollution” feature is mainly due to the strong valley winds that prevent inversions and bring unpolluted air from the mountains. An exposure situation with high noise levels and low air pollution is rarely seen and supports the noise hypothesis as explanation for the excess medications.

Nevertheless, caution must be applied, because the semi-ecologic study design and the fact of age as the only considered confounder limits a save interpretation.

On the other hand, the data base from this social security group covers roughly 80% of residents with a balanced social mix – excluding only self employed and farmers.

A definitive advantage of such a database is that self-selection due to non-participation is not an issue – given the GIS-assignment rates are as high as in this study (95%).

The consistent observation that the highest excess risk occurs in the oldest age group reminds that most epidemiologic studies do not cover this large age range – and for this reason may miss relevant associations due to shortened latency times.

The fact of using only prescription drugs may be seen as a drawback, as some studies observed more stable associations with OTC-drugs. This is most obvious with sleeping pills, where only 2% use prescriptions in this study. However, it should be mentioned that Austria is among the countries with the lowest prescription rates for psychoactive drugs in Europe [3].

From the viewpoint of health economics it is also important to state that the three groups with the most consistent link to rail exposure are among the top 10 prescriptions with the highest economic impact in this area.

5 CONCLUSIONS

The use of medication data bases is an underutilized source of medical outcome information. The main advantages are the broad available age information and the potential lack of selection bias, when address linking is successful. From this semi-ecologic analysis, there is evidence for higher risk of high noise exposure from fright trains during night. The

data also support longer latency times for health effects to occur with environmental exposures, as the highest risk estimates were observed in the highest age group. Alternatively, you would have to postulate a higher sensitivity of the older population.

6 ACKNOWLEDGEMENTS

We want to thank the social security staff of the Tyrolian GKK (Mr Hosp, Mag Jelinek) for the technical support and the administrative help of the governmental health (Mag Larcher-Ploder) and land use administration (Dr Riedl). Further thanks go to the transnational Brenner Base Tunnel consortium (BBT-SE) for the financial support received.

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cholesterol were associated with annoyance from road traffic and railway noise, respectively. This difference can be explained with the fact that aircrafts do not fly over this area around midnight, though the other traffic noises occur all day through.

16:20–16:40

370.....*Invited*

An epidemiological study on noise in Paris area: methods and preliminary results

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Additional Authors: Jean-Marie Cohen, Jean-Marc Abramowitch, Agnès LeFranc

Recent working groups and meta-analysis suggest , globally speaking, a relationship between noise exposure level and a high risk of health response (hypertension, or blood pressure or sleep disturbance). In a previous survey , carried out in 1997-98, around Paris-Roissy airport by OPENROME and INRETS, the feasibility of a cooperation from doctors has been shown, but no significant effects of aircraft noise on health, despite some trends (too small sample). In 2005, a larger survey has been designed to try to reveal , in a large region, around a main town like Paris, including 4500 people to be recruited systematically at the cabinet of the doctors, as to avoid a possible bias by a telephone survey, and the difficulty to assess the non-answers. The paper describes the sampling design, to get a significant exposure to noise in Paris area, the combination of noise sources, mainly from transports and first results.

16:40–17:00

376.....*Invited*

Rail exposure and the prescription of medicines

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Additional Authors: Johannes Ruedisser, Edda Amann, Dick Botteldooren

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. Whether transportation noise exposure may be associated with the prescription of medicines is still a subject of discussion, and the number of available papers on this subject is limited. Most papers deal with road or aircraft noise. This study used social security data to assess whether road or rail exposure is associated with the prescription of medicines. For this purpose the population (N=28025) of a contiguous area was sampled by means of a GIS based on the distance to the transportation source (highway, main road, local roads, rail, mixed exposure). In a first step the age-stratified medication use of the various transportation samples was compared against the prevalence of medicine use of the population living outside the chosen distances to the transportation sources („the unexposed"). Prescription of medicines was mainly associated with exposure to the rail track, while local roads showed no increased risks. Medications against depression, antacids, and antiallergics were among the prescriptions most consistently associated with higher odds ratios. Furthermore, the risk estimates increased with increasing age, except for antiallergics.

17:00–17:20

975.....*Invited*

Hypertensive disease in sawmill workers chronically exposed to high noise levels

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An important function of hearing is to warn and to elicit stress reactions through the sympathetic nervous and endocrine systems. When continually excited by noise stimuli, these otherwise normal transient responses may persist and become pathogenic; one hypothesized health outcome of such dysregulation is hypertension. Several earlier studies have linked exposure to workplace and community noise to hypertension, but results have not been consistent. We recruited 10,832 subjects who were employed in 14 Canadian sawmills and followed them for the years 1991 to 1998. Cases were subjects who had either 3 visits to a physician's office within any 70 day period or a hospital admission with ICD-9 = 401-405. Cumulative exposure levels (dBA*Yr) and duration of time exposed above specific thresholds (85, 90 and 95 dBA) were estimated for subjects. Relative risks were estimated using Poisson regression with the lowest exposure group as reference. Risk of hypertension rose monotonically with increasing cumulative exposure, with those in the highest exposed population (>115 dB.Year) having a relative risk of 1.3. Results for duration spent above a threshold noise level gave similar results, for example those working >29 years above 85 dBA having a relative risk of 1.5.

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