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NOISE EXPOSURE, NOISE SENSITIVITY, SLEEP AND SUBJECTIVE HEALTH: RESULTS FROM A COMMUNITY SAMPLE

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ABSTRACT

The present research project is investigating associations between noise exposure, noise sensitivity, noise disturbed sleep and health. This is being done in two ways, the first examining subjective reports and the second looking at objective measurements. Results from the first questionnaire study showed that perceived noise exposure was related to impaired subjective health. This was also found when noise sensitivity was examined. The associations between noise sensitivity and health were no longer significant when negative affectivity was co-varied. Noise and noise disturbed sleep were associated with poorer recent health and this effect was still significant when negative affectivity was co-varied. The present results do not allow us to determine the causality of the effects: Does noise disturb sleep and lead to poorer health or does impaired health make one more susceptible to noise disturbed sleep which may then influence the perception of noise exposure. Only a longitudinal study will provide the appropriate information to answer this question.

1 - INTRODUCTION

The present project combines two different approaches to examine associations between community noise exposure, sleep disturbance, noise sensitivity and psychiatric disorders. The first approach involves a longitudinal community survey that not only allows identification of cross-sectional and lagged associations but permits assessment of adaptation and response to change. Following this, sub-groups defined in terms of noise exposure, noise sensitivity, sleep disturbance and psychopathology have their sleep assessed using actimeters and levels of noise exposure objectively recorded. The outcomes of these different approaches will enable us to test different models of associations between noise, noise annoyance and sensitivity and psychiatric disorder.

There is evidence of both objective and subjective sleep disturbance by noise [1,2]. There is some evidence that noise effects on sleep may habituate over time, but research also suggests that small deficits may persist for years [3]. This often leads to greater use of sleeping pills in high noise areas. Noise not only affects sleep but may have after-effects the following day [4]. This could provide a possible mechanism for the effects of noise on psychosocial well-being. Noise exposure during sleep is considered to increase awakening or cause shifts from deeper to lighter sleep stages [5]. Noise during the day may also reduce REM sleep [6] which shows that noise can influence sleep in several different ways. Annoyance caused by noise is a major source of complaint to local environmental health offices. Indeed, it is an undisputed fact that people are annoyed by a wide range of external noise events. It is also clear that non-auditory factors such as noise sensitivity and attitudes to noise are important in determining the level of annoyance [7,8]. Psychiatric disorder and noise has been examined in a variety of ways. For example, there have been studies of noise and psychological symptoms both in the workplace [9] and community [10]. There have also been studies of noise exposure and mental hospital admissions [11]. Other research has examined noise and psychiatric morbidity in the community [12]. Noise annoyance is associated with noise level and

with reporting of symptoms. What is unclear is the relationship between noise exposure, disturbed sleep, annoyance and noise sensitivity and psychiatric disturbance. Some simple relationships between these factors can be largely ruled out by earlier findings. For example, both noise and psychiatric disturbance are associated with annoyance, but it appears to be psychiatric morbidity influencing annoyance rather than the other way around [10]. The present research focuses on sleep disturbance. The research assesses the impact of community noise on sleep and on subjective reports of health. Objective and subjective measures of noise sensitivity are recorded as are general noise annoyance and annoyance produced by specific noise exposures. The present paper reports preliminary results from the first study in the project.

2 - METHOD

A random community sample of 2,000 were identified from the Electoral register. They were informed that the survey was concerned with insomnia. Standard questionnaires assessing sleep (the newly developed Bristol Sleep Questionnaire), noise sensitivity [13,14], noise annoyance [13], psychiatric disorder (GHQ – Goldberg & Williams, [14]) and general subjective health were sent to the participants. Multi-dimensional assessment of perceptions of exposure to noise (estimates of type of noise exposure, duration and intensity) were also included. Negative affectivity (the tendency to be sensitive to or be inclined to report negative features of the environment) was also measured using the Eysenck Personality Inventory [15].

543 respondents returned completed questionnaires. Ages ranged from 20 to 98 years. There were 256 males and 287 females. The mean age for males was 52.1 years, for females, 47.2 years. Demographic data supplied by the respondents was compared with the 1991 Census data for the area, and the sample was found to be representative of the general population [16].

3 - RESULTS

Initial analyses were conducted to assess associations between perceived noise exposure and the health outcomes, noise sensitivity and the health-outcomes, and noise disturbed sleep and health. Interest here focuses on the total symptoms over the last 14 days.

Noise exposure

Reported frequency of noise exposure was summed across all time periods (day, evening, week day, weekend) to give a general noise exposure factor. High and low noise exposure groups were compared using a median split. High noise exposure was significantly associated with more symptoms in the last 14 days. This effect is shown in Table 1.

Noise sensitivity

Noise sensitivity was related to a greater number of self-reported symptoms in the last 14 days. These data are shown in Table 1.

Noise disturbed sleep

Noise disturbed sleep was also significantly associated with recent symptoms. These data are shown in Table 1.

Variable	Low group	High Group	p values
Noise exposure	2.94 (0.20)	4.93 (0.26)	p < 0.0001
Noise sensitivity	3.46 (0.18)	4.44 (0.25)	p < 0.005
Noise disturbed sleep	3.04 (0.18)	4.70 (0.23)	p < 0.0001

Table 1: Effects of frequency of noise exposure, noise sensitivity and noise disturbed sleep on total symptom scores for the last 14 days (scores are the means, s.e.s in parentheses; maximum score=18).

Age and negative affectivity

Both age and negative affectivity were found to have highly significant effects on sleep and health. They were, therefore, entered as covariates in new analyses examining noise exposure, noise sensitivity, noise disturbed sleep and health.

Analyses of co-variance

The above analyses were repeated adjusting for the effects of age and negative affectivity. The majority of the effects of noise exposure and noise sensitivity were no longer significant when age and negative affectivity were co-varied. However, noise exposure and noise disturbed sleep were still associated with more symptoms in the last 14 days. These data are shown in Table 2.

Variable	Low group	High group	p values
Noise exposure	3.47 (0.2)	4.25 (0.2)	p < 0.01
Noise sensitivity	3.96 (0.17)	3.64 (0.19)	NS
Noise disturbed sleep	3.47 (0.17)	4.17 (0.17)	p < 0.01

Table 2: Effects of frequency of noise exposure, noise sensitivity and noise disturbed sleep on total symptom scores for the last 14 days when age and negative affectivity are co-varied (scores are the adjusted means, s.e.s in parentheses).

4 - DISCUSSION

The present study examined the relationships between subjective perceptions of community noise at night, noise sensitivity, disturbed sleep by noise and reports of health. Analyses showed that reports of noise exposure, noise sensitivity and noise disturbed sleep were associated with reports of impaired health. All of the factors of interest were found to be related to health and there were few interactions between the variables. The health measures were also found to be influenced by age and negative affectivity. Analyses of covariance, with age and negative affectivity as covariates, revealed that most of the associations between noise exposure, noise sensitivity and health disappeared. The major influence on health was negative affectivity and this factor accounted for the earlier associations between noise exposure, noise sensitivity and health. Noise disturbed sleep was associated with reported health in a more robust way and many of the associations still remained when negative affectivity and age were co-varied. Both noise and noise disturbed sleep were associated with more symptoms in the last 14 days even when age and negative affectivity were co-varied. However, it should not be concluded that the present data shows that noise and noise disturbed sleep lead to impaired health. The causality could actually be the other way around, with those with impaired health being more sensitive to disturbed sleep from noise at night and this increasing their perception of frequency of noise exposure. Only a longitudinal study will give an indication of the causal mechanisms linking noise exposure, sleep disturbance produced by noise and reports of impaired health.

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