



Perceptions of noise at work and road traffic accidents

Andrew P Smith¹

¹ Cardiff University, School of Psychology, Cardiff, UK (corresponding author)

Corresponding author's e-mail address: smithap@cardiff.ac.uk

ABSTRACT

There is an extensive literature linking noise at work to accidents in the work place. The present study extended this research by examining associations between perceptions of exposure to noise levels that led to distraction and road traffic accidents. The survey was completed by 5286 workers from the South Wales region. Perceptions of noise at work were measured using a 5-point rating scale. Road traffic accidents (RTAs) where the person was the driver were recorded and categorised into those at work, commuting to and from work, and in leisure time outside of work. Results showed that those who reported greater exposure to noise at work had more RTAs. This effect remained significant when other predictors of RTAs were statistically controlled for. Perception of noise at work was associated with increased accidents in leisure time but not at work or while commuting. This result confirms findings on after-effects of noise exposure. Further research using a longitudinal design will provide a better indication of causality. Similarly, it is desirable to obtain more information about noise exposure and possible confounding factors.

INTRODUCTION

Much of the research on noise and performance has involved laboratory studies of artificial tasks [1, 2, 3]. There have been studies of real life activities [4, 5, 6] and accidents at work [7, 8, 9, 10], and these have confirmed effects seen in the laboratory. The laboratory research has also demonstrated that there are after-effects of working in noise [11, 12]. These studies have shown that impairments may be present even when the acute noise exposure has finished. These chronic effects of noise exposure have, more recently, been demonstrated in studies examining the effects of aircraft noise exposure on children's cognitive functioning [13, 14].

The present research focused on road traffic accidents (RTAs). There have been many studies of transport noise and most have examined the effects of this type of noise on the community. Studies of the effects of noise on driving are rare, although one recent study [15] showed that low frequency noise led to impaired performance on a driving simulator. The present study continued research on effects of working conditions on driving. The best example of the nature of work influencing driving outside of work comes from research on nightshift workers, who are at greater risk of having an accident when driving home after work [16]. Work-related factors can influence driving at times after the commute home. For

example, one recent study [17] showed that bullying at work can lead to an increased number of RTAs in leisure time. This may reflect the person thinking about the bullying which interferes with driving performance.

Another recent study [18] has shown that exposure to noise at work was associated with a greater risk of having a road traffic accident. This study involved a survey of over 2,000 drivers and had the key methodological feature of controlling for many other risk factors for an RTA. However, it did not collect data on when the RTA occurred and the present study extended the research by doing this (recording information on whether the RTA occurred at work, commuting to and from work, or in leisure driving). The present research examined perceptions of noise at work rather than using objective measurement.

METHOD

The survey was carried out by 5286 workers in the South Wales region selected from the electoral register. The study was approved by the ethics committee, School of Psychology, Cardiff University, and carried out with the informed consent of the volunteers. Road traffic accidents, where the respondent was the driver, were recorded, as was the time when the accident occurred (at work; commuting to work; commuting from work; and leisure times). The perception of noise item has been widely used in recent research on the behavioural effects of noise [19, 20]. It asks about exposure to background noise that interferes with attention, with ratings being “often, sometimes, seldom or never”. Demographic information, other job characteristics, health status and individual variation in factors such as risk-taking were recorded and used as covariates.

Participants

The participants were 5286 workers with a mean age of 39.2 years (s.d. 11.9) and 43.2% were male. 26.7% were educated to degree level. 68% were married or cohabiting, 23.1% single, 7.6% divorced and 1.3% widowed. 77% were in full-time employment and 86.2% had permanent contracts.

RESULTS

Noise exposure

39.1% of the sample were exposed to some extent to background noise which influenced their ability to concentrate (7.1% often; 15.9% sometimes and 9.1% seldom). They were compared with those who stated that they were never exposed to noise that influenced their concentration.

RTAs and noise

Cross-tabulation of noise x RTA showed that 6.3% of those in the noise group reported an RTA where they were the driver compared to 4.9% of the no noise group. This was statistically significant (chi square =4.26 $p < 0.05$). Analysis of the individual types of RTA showed that the difference between noise and no noise groups was due to a higher number of accidents in leisure time in the noise group (Noise: 1.5%; No Noise: 0.8%; chi square = 4.21, $p < 0.05$).

In order to adjust for possible confounders, multinomial logistic regressions were carried out. In the first regression, the dependent variable was the different types of RTA and the predictor variable was noise group. Those in the noise group were more likely to have RTAs in their leisure time (OR = 1.91 CI 1.12, 3.26 $p < 0.05$) but not at other times. The next regression controlled for other predictors (demographics, health and risk taking). The effect of noise on RTAs in leisure time remained significant in this regression (OR = 1.87, CI 1.09, 3.20 $p < 0.05$).

DISCUSSION

The results from the present study confirmed that noise at work was a risk factor for RTAs. This effect held up when confounding factors were controlled in the analyses. This result replicates the findings of our earlier study []. A novel feature of the present study was the collection of information about when the RTA occurred. The results showed that it was accidents in leisure time that increased in the noise group. One must now ask what underlies such an effect. First, it could reflect other confounding factors which were not controlled for here. Secondly, it could reflect state of the person that may transfer to life outside work. For example, exposure to noise may lead to fatigue which may persist in leisure time. Alternatively, attentional styles influenced by noise may transfer to other situations. There is strong evidence that noise influences the ability to sustain attention and if this continue after work then it could plausibly explain the results found here.

In order to understand the underlying mechanisms it is necessary to collect more information about the time and type of RTA. Given very large numbers of participants are needed to examine risk factors for RTAs it might be better to conduct more studies of driving simulation and determine the effects of prior noise exposure on driving parameters known to be important in driver safety.

REFERENCES

- [1] Smith, A. P. (1989). A review of the effects of noise on human performance. *Scandinavian Journal of Psychology*, 30, 185 - 206.
- [2] Smith, A. P. & Jones, D. M. (1992). Noise and performance. In: *Handbook of human performance, Vol.1: The physical environment*. (eds) A P. Smith & D. M. Jones. London: Academic Press. pp1-28.
- [3] Smith, A.P. (2012). An update on noise and performance. Comment on Szalma and Hancock (2011). *Psychological Bulletin*, 138(6), 1262-1268.
- [4] Weston, H.C. & Adams, S. (1932). The effects of noise on the performance of weavers. *Medical Research Council Industrial Health Research Board Report*, 65, 38-62.
- [5] Broadbent, D.E. & Little, E.A.J. (1960). Effects of noise reduction in a work situation. *Occupational Psychology*, 34, 133-140.
- [6] Levy-Leboyer, A. & Moser, G. (1988). Noise effects on two industrial tasks. In *Proceedings of Fifth International Congress on Noise as a Public Health Problem*, edited by B.Berglund, U.Berglund, J. Karlsson, & T.Lindvall. Stockholm: Swedish Council for Building Research. Pp. 43-48.
- [7] Kerr, W.A. (1950). Accident proneness of factory departments. *Journal of Applied Psychology*, 34, 167-170.
- [8] Cohen, A. ((1976). The influence of a company hearing conservation programme on extra-auditory problems of workers. *Journal of Safety Research*, 8, 146-162.
- [9] Smith, A. P. 1990. Noise, performance efficiency and safety. *International Archives of Occupational and Environmental Health*, 62, 1 - 5.

- [10] Smith, A.P. (2011). Effects of noise, job characteristics and stress on mental health and accidents, injuries and cognitive failures at work. 10th International Congress on Noise as a Public Health Problem. *Institute of Acoustics: London*. Pp. 486-492.
- [11] Glass, D.C. & Singer, J.E. (1972). *Urban Stress: Experiments on Noise and Social Stressors*. London and New York: Academic Press.
- [12] Cohen, S., Evans, G.W., Krantz, D.S. & Stokols, D. (1980). Physiological, motivational and cognitive effects of aircraft noise on children: Moving from the laboratory to the field. *American Psychologist*, 35, 231-245.
- [13] Stansfeld, S. A., Berglund, B., Clark, C., Lopez-Barrio, I., Fischer, P., Ohrstrom, E., et al. (2005). Aircraft and road traffic noise and children's cognition and health: a cross-national study. *Lancet*, 365(9475), 1942-1949.
- [14] Clark, C., Martin, R., van Kempen, E., Alfred, T., Head, J., Davies, H.W., Haines, M.M., Lopez Barrio, I., Matheson, M., & Stansfeld, S.A. (2006). Exposure-Effect Relations between Aircraft and Road Traffic Noise Exposure at School and Reading Comprehension: The RANCH Project. *American Journal of Epidemiology*, 163 (1), 27-37,
- [15] Anund A., Lahti E., Fors C., & Genell, A. (2015). The Effect of Low-Frequency Road Noise on Driver Sleepiness and Performance. *PLoS ONE* 10(4):e0123835.
- [16] Lee, M.L., Howard, M.E., Horrey, W.J., Liang, .Y, Anderson, C., Shreeve, M.S., O'Brien, C.S., Czeisler, C.A. (2016). High risk of near-crash driving events following night-shift work. *Proc Natl Acad Sci U S A*, 113(1):176-81.
- [17] Bowen, L. & Smith, A.P. (2020). When did the collision happen? Exploring predictors of RTC involvement. Contemporary Ergonomics and Human Factors 2019. Chartered Institute of Ergonomics and Human Factors.
- [18] Bowen, L. & Smith, A.P. (2019). Associations between job characteristics, mental health and driving: A secondary analysis. *Journal of Education, Society and Behavioral Science*, 29 (2), 1-25.
- [19] Smith, A.P. (2003). Noise, accidents, minor injuries and cognitive failures. *8th International Congress on Noise as a Public Health Problem*. Edited by R.G. de Jong, T.Houtgast, E.A.M. Franssen & W.F. Hofman. Schiedam: Foundation ICBEN 2003. pp. 140-144.
- [20] Smith, A.P. 2017. Effects of noise on errors, injuries and subjective health of nursing staff. ICBEN 2017.