Investigating the impacts of wind turbine noise on quality of life in the Australian context: A case study approach.

David MCBRIDE[1]; Daniel SHEPHERD[2]; Robert THORNE[3]

[1] University of Otago, New Zealand

[2] Auckland University of Technology, New Zealand

[3] Noise Measurement Services, Australia

ABSTRACT

The WHO considers noise pollution to be of sufficient threat to public health to justify the publication of guidelines on noise effects and mitigation. 'Community noise' has largely been studied in the context of transportation and general neighbourhood noise, with exposure to wind turbine noise relatively understudied for historical, methodological, and political reasons. There also appears to be a general uncoupling of wind turbine noise from the other sources, which endows upon it an exclusivity that excuses it from the methods, guidelines, and critique used for other noise sources. This study aimed to advance understanding of wind turbine noise impacts by adopting a case study approach based on detailed information from 25 individuals, Australian adults residing rurally and within 1000-3500m of three or more wind turbines. Participants were selected on the basis of health concerns evidenced through statutory declarations or submissions to hearings. The 25 respondents compeleted a face-to-face survey measuring health-related quality of life (HRQOL) questionnaire as developed by the World Health Organisation (WHO), the 'WHOQOL-BREF'. The results were compared to normative population data and showed clinically significant reduction in HRQOL.

Keywords: Wind farm noise, Sociological effects; community reaction to noise

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1. INTRODUCTION

The World Health Organization considers noise pollution to be of sufficient threat to public health to justify the publication of guidelines on noise effects and mitigation (1, 2). The impact of 'community noise' on health has however largely been studied in the context of transportation and general neighbourhood noise.

Wind farms consist of clusters of wind turbines, which, when placed in rural areas, are associated with intrusive and unwanted sound. Wind turbine noise has characteristics sufficiently different from other, more extensively studied, noise sources to suggest that standard industrial noise standards are not appropriate for measurement and assessment purposes. In particular, we submit that time-aggregated noise metrics have limited utility in assessing the potential risks to individual human health and well being, also that the effects extend well beyond the direct physical effect of noise-induced hearing loss.

Though research into the human impacts of wind turbine noise has appeared only in small quantity, the data suggest that, for equivalent exposures, wind turbine noise is more annoying than road or aviation noise. Furthermore, the particular characteristics of wind turbine noise may be likely to cause sleep disruption.

In consequence we propose that more global metrics of health should be used in order to describe and estimate the health effects on individuals and communities.

[1] david.mcbride@otago.ac.nz

[2] daniel.shepherd@aut.ac.nz

[3] bob@noisemeasurement.com.au

This Report presents the findings from a small study undertaken in Victoria, Australia. A sample of individuals (n=25) exposed to wind farm noise completed a survey probing health-related quality of life (HRQOL).

2. METHODS

2.1 Identification of study group

We identified two wind farm locales, Waubra and Cape Bridgewater, at which noise levels were of concern and where residents had expressed worries about their health. The potentially noise affected individuals lived between 700 metres to a distance of around 3500 metres from the turbines, with an 'average' of 1400 metres.

2.2 Survey instruments

Health-related Quality of life was measured using the WHOQOL-BREF (3), which consists of 26 items divided into four domains: physical health (7 items), psychological wellbeing (6 items), social relationships (3 items), and environmental factors (8 items). There are two additional items probing overall quality of life and general health. All 26 items in the WHOQOL-BREF consist of statements that are rated on a five point Likert scale. The respondents are asked to respond to these items, keeping the last two weeks in mind. Lower domain scores indicate more negative perceptions of HRQOL, while higher scores indicate higher and more positive evaluations. The WHOQOL instruments have been shown to have excellent reliability and validity. Furthermore, the WHOQOL-BREF has also been tested for its validity for different cultural groups and results demonstrate that the WHOQOL-BREF is a valid instrument to use across different cultural groups.

Quality of life is defined by the WHO (1997) as:

"An individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in a complex way by the person's physical health, psychological state, personal beliefs, social relationships and their relationship to salient features of their environment"

The WHOQOL was administered during face-to-face interviews.

2.3 Statistical method

The mean score was calculated for each WHOQOL domain and for individual items (data not shown). Internal consistency was then calculated using Cronbach's alpha. The mean scores were subsequently transformed to allow comparisons with data derived from the full WHOQOL 100 item instrument. The results were then compared with Australian normative WHOQOL data (4) and with data from the Longitudinal Investigation of Depression Outcomes (LIDO) Study.

3. Results.

Twenty-five individuals took part in the survey. Table 1 shows the Summary statistics and Cronbach's alpha (α_c) for the domain scores.

Table 1 – Summary statistics and Cronbach's alpha (α_c) for domain scores

Domain	Mean	Standard Deviation	α_c
Physical	18.80	5.97	.880
Psychological	17.68	5.15	.887
Social	10.16	3.14	.695
Environmental	25.15	6.47	.841

Estimates of Cronbach's alpha are above, or sufficiently close to, α_c=0.7, indicating that the data can be considered statistically reliable. The transformed scores are shown in table 2.

Table 2 – Comparison of WHOQOL scores

Group	Physical	Psychological	Social	Environmental
Turbine	42.43	48.67	59.67	53.63
Community	73.50	70.60	71.50	75.10
Outpatient (LIDO)	61.47	65.37	62.89	67.93
Inpatient (LIDO)	51.55	64.04	63.36	66.99

It is clear that the study group had lower scores in all the WHOQOL domains.

4. DISCUSSION.

Based on these results, there is evidence that those living in proximity to wind farms have a lower quality of life as measured by the WHOQOL-BREF, and embodied in the WHO definition of health, "A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."

The weakness of the study was the small sample size, which limits the ability to draw comparisons. This is the nature of wind farm noise research, as discrete exposed populations are small. It is however important to study such populations, as each soundscape may be unique. Reporting bias must also be considered, however the evidence here is taken from a validated instrument providing global health metrics and represents the experience within the community. The small sample size also meant that we were unable to account for confounding, for example age. The scores that we found were however worse than those found even in older age groups (4).

The results are consistent with other work that we have carried out (5,6), which tries to explain the nature of the relationship between wind farm noise and health. This is a complex undertaking involving a number of intermediate variables between exposure and outcome. These include the noise sensitivity of individuals, also what we argue to be primary health effects, annoyance and sleep disturbance. The interaction, however mediated, eventually leads, as we believe has happened here, to stress and degraded quality of life.

As regards future work, the use of subjective versus objective health measures to detect changes in health due to environmental factors may be viewed as 'soft'. Objective outcome metrics such as blood pressure or chronically elevated cortisol levels are arguably well defined and easily measured, while noise-induced sleep disruption, stress, and similar subjective symptoms are less easily measured and distinguished from the background levels present in the population. However, objective manifestation of health effects associated with noise-related annoyance may emerge after some years since the onset of exposure, whereas subjective appraisals of wellbeing and health suffer no such time lag. Thus for cross-sectional studies, as reported here, subjective measures are more suitable.

5. CONCLUSIONS

In summary, the fact that so many individuals scored so poorly must be a cause for concern. We submit that wind farm noise may be a 'more than trivial' health hazard, our results indicating an obvious deterioration in HRQOL. The relationship between the noise and health may be complex, but needs to be understood. At this time, however, our understanding is insufficient to describe the relationship between wind turbine noise and health. Legislation should apply the precautionary principle or conservative criteria when assessing proposed wind farm developments.

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