Health and Wind Turbines

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Professional Background

• Brigham and Women’s Hospital, Boston, Harvard Medical School
• Occupational Environmental Medicine Specialist past 38 years (Board certified)
• Editor of major text book: “A Practical Approach to Occupational and Environmental Medicine” (all 3 editions)
• Past president, American College of Occupational and Environmental Medicine
• Visiting Scientist at Harvard School of Public Health (HSPH) and member of Residency Advisory Committee (HSPH)
Background on Noise and Health

• Author: 3 book chapters on noise and health
• Lecturing over 15 years at Harvard School of Public Health on noise and health
• Lead Author: “Wind turbines and Health: A critical review of a proposed case definition.” Published by Noise and Health, 2015
Purpose of Presentation

1. Address potential Health Implications of living near wind turbines

2. Focus: Major epidemiological study of people living near wind turbines - Health Canada - and a comprehensive review of the medical and scientific literature conducted by investigators assembled by the Massachusetts Institute of Technology
What is Health Canada and what did it do?

• Canadian governmental health agency similar to USA National Institutes of Health (NIH)
• Conducted the Community Noise and Health Epidemiology Study to address potential impacts of wind turbine noise (WTN) on health and well-being.
What is Epidemiology?

• Environmental Epidemiology: Study of large group of people to assess health risks in light of exposure to a potential hazard.

• Cross sectional studies evaluate links between an exposure and certain health end points at one point in time—the Most common type used to evaluate health implications of living near wind turbines.

• Strengths of these studies include their economy in comparison to lengthy longitudinal studies.
Health Canada Study

Investigators submitted proposed methodology to extensive peer review prior to the study, including:

• The Health Canada Science Advisory Board; a 27 member expert committee,
• World Health Organization’s (WHO) Noise Committee,
• Health Canada’s research ethics board
• Public comments about the proposed methodology- 950 submissions.
Health Canada Study

• $2.1 million study
• Largest group of people (1238) studied regarding potential health implications of living near wind turbines
• Cross-sectional epidemiological study conducted between May and September 2013
• Participants: 1238 randomly selected people living between 0.25 and 11.22 km (approximately 820 ft. and 7 miles) from operational wind turbines.
• First study in which objective measures of health, including stress, sleep and blood pressure were assessed.
• Results published in five separate peer reviewed journals.
Health Canada Study

Published Reports included results related to:
1. General Health
2. Sleep
3. Stress
4. Personal and situational factors associated with annoyance
5. Quality of life
Health Canada Study

• **Health**-assessed by a questionnaire and objective measures of stress, sleep and blood pressure.

• **Noise**-assessed by internationally accepted protocols, sound recordings, including low frequency noise, inside and outside on a number of homes and infrasound measurements.
Health Canada Study: Results

Wind turbine noise was **not** associated with self-reported:
- Sleep disturbance
- Illnesses and chronic health conditions;
- Perceived stress and quality of life.
Health Canada

• “Self-reported health effects (e.g., migraines, tinnitus, dizziness, sleep disturbance, sleep disorders, quality of life, and stress) were not related to wind turbine noise (WTN) levels.

• Visual and auditory perception of wind turbines increased significantly with increasing WTN levels as did high annoyance toward several wind turbine features, including noise, blinking lights, shadow flicker, visual impacts, and vibrations...
Health Canada

• Beyond annoyance, results do not support an association between exposure to WTN up to 46 dBA and the evaluated health-related endpoints.” (Michaud et al, 2016 a).

• Wind turbine noise levels reached 46 dB, yet no health problems were associated with these levels.
Health Canada Study and Sleep

• First study that evaluated implications on sleep due to living near wind turbines with both subjective and objective measures of sleep.

• The Pittsburgh Sleep Quality Index (PSQI), a well-validated questionnaire to assess sleep, was used.

• PSQI measures the subjective experience of sleep- one of the most common methods used in sleep research.
Health Canada Study and Sleep

- Authors concluded “results do not support an association between exposure to outdoor WTN up to 46 dB (A) and an increase in the prevalence of disturbed sleep.
- WTN levels averaged over 1 year
- NOTE: Although noise at certain levels can affect sleep, this study showed no adverse effects on sleep from wind turbine noise levels up to 46 dB-consistent with WHO Nightime Noise Guidelines. As the curve that follows indicates, no adverse effects on sleep were expected at noise levels up to 46 dB and this was demonstrated by Health Canada.
Fig. 3.1

Health Canada Study and Stress

1. First study to assess stress associated with wind turbine noise (WTN) using self-reported and objective measures.

2. WTN exposure had no apparent influence on
   • perceived stress scale (PSS) scores,
   • hair cortisol concentrations,
   • resting blood pressure, and
   • heart rate

**Conclusion:** findings do not support an association between exposure to WTN up to 46 dBA and elevated self-reported and objectively defined measures of stress.” (Michaud et al, 2016, D)
Health Canada Study: Annoyance

- Some people living near wind turbines have reported annoyance.
- ~9% of self-reported annoyance was attributed to Wind Turbine Noise levels.
- Factors associated with WTN annoyance included personal benefit, noise sensitivity, physical safety concerns, property ownership.
- Annoyance was only weakly associated with WTN levels.

*R²-corrrelation coefficient-any R²< 0.5 shows no link
Annoyance

• Annoyance is a *subjective* phenomenon, related primarily to attitudes to the visual impact of turbines and economic benefit associated with wind farms. (Pedersen *et al*, 2011; 2009; 2007; 2004)


• Annoyance is not an adverse health effect. It is not listed as a disease entity in the 10th revision of the International Classification of Diseases (ICD-10).
Health Canada and Quality of Life

- World Health Organization methodology used to assess quality of life
- WTN levels were not related to scores on the Physical, Psychological, Social or Environment domains, or to rated QOL and Satisfaction with Health questions.
- Visual “annoyance” was a major feature that affected people’s perception of quality of life but noise from a turbine had no appreciable effect.
- Results do not support an association between exposure to WTN up to 46 dBA and QOL assessed using the WHOQOL-BREF questionnaire.”
Health Canada Study: Conclusions

Wind turbine noise was not associated with self-reported:
• Sleep disturbance
• Illnesses and chronic health conditions;
• Perceived stress and quality of life.
How does Health Canada contrast with MIT Study?

Authors of MIT Study:

• Occupational/environmental medicine specialist; Noise engineer; Epidemiologist; Otolaryngologist; Psychologist; Public Health Physician
MIT Study: Wind Turbines and Health

1. Is there sufficient scientific evidence to conclude that wind turbines adversely affect human health?

2. Is there sufficient scientific evidence to conclude that psychological stress, annoyance and sleep disturbance occur as a result of living near wind turbines? Do these effects lead to adverse health effects?

3. Is there evidence to suggest that infrasound and low frequency from wind turbines have unique potential health effects not associated with other sources of environmental noise?
What is the environmental “exposure” of concern with wind turbines?

• The main potential hazardous exposure is noise, however, concerns have also been raised about components of sound (i.e. infrasound, low frequency sound), EMF and shadow flicker
Do wind turbines affect health?

Epidemiology Studies: Rich literature on environmental noise on human health dating to the 1970s

• Occupational Noise Exposure

• Environmental Noise Exposure-airports, highways, rail yards, construction

• Wind Turbines and Health

Experimental: infra sound on health
Summary of MIT Study

1. Infrasound is emitted by wind turbines—levels of infrasound at customary distances to homes are typically well below audibility thresholds.

2. Among epidemiological studies of better quality, no clear association is seen between wind turbine noise and harm to human health.

3. Components of wind turbine sound, including infrasound and low frequency sound, do not present unique health risks.

4. Annoyance associated is a complex phenomenon related to personal factors. Noise from turbines plays a minor role in comparison to other factors in leading people to report annoyance in the context of wind turbines.
New Studies: Do they confirm or refute earlier results?

• The most recent studies conducted in Denmark identified Danish homes within a radius of 20 times the height of the closet wind turbine. (Paulson et al, 2019)

• 717,453 people lived near wind turbines.

• Estimated hourly outdoor and low frequency wind turbine noise for each dwelling and derived 1 year and 5 year nighttime averages.

• Conclusions: no “convincing evidence of associations between wind turbine noise and myocardial infarction and stroke.”

• No link between living near wind turbines and adverse sleep and antidepressant use; aside from those older than 65; in the latter subgroup, an increase in use of sleep medications was associated with noise levels from 36 dB to > 42 dB.

• No associations noted between living near wind turbines and reproductive outcomes; diabetes; and hypertension
What about these internet blobs about health problems?
Caution in a Causality Assessment:

Caution in assessing causality

Symptoms non specific and have numerous causes

• Recall Bias may be a factor

• Alternative explanations need to be addressed (i.e. sleep, tinnitus, sleep disturbance all have multiple causes)
Questions/Discussion