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Diagnostic criteria for adverse health effects in the environs of wind turbines

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Summary

In an effort to address climate change, governments have pursued policies that seek to reduce greenhouse gases. Alternative energy, including wind power, has been proposed by some as the preferred approach. Few would debate the need to reduce air pollution, but the means of achieving this reduction is important not only for efficiency but also for health protection. The topic of adverse health effects in the environs of industrial wind turbines (AHE/IWT) has proven to be controversial and can present physicians with challenges regarding the management of an exposure to IWT. Rural physicians in particular must be aware of the possibility of people presenting to their practices with a variety of sometimes confusing complaints. An earlier version of the diagnostic criteria for AHE/IWT was published in August 2011. A revised case definition and a model for a study to establish a confirmed diagnosis is proposed.

Keywords

Case definition, clinical diagnosis, wind turbines, adverse health effects, symptoms

Introduction

In an effort to address climate change, governments seek to reduce greenhouse gases. Alternative and/or renewable energy, including wind power, has been proposed by some.[1,2] In 2008, the World Health Organization (WHO) states that governments must 'ensure that economic and social policy responses to climate change and other environmental degradation take into account health equity' while 'addressing the exclusionary policies and processes that lead to rural poverty, landlessness, and displacement of people from their homes'.[3] Have these admonitions been heeded? Evidence from adverse event reports indicates this may not be the case.[4–6] For this reason, rural physicians in particular must be aware of the possibility of people presenting to them with multisystem complaints that may be initially confusing (see 'Third-order criteria' section).[7] In order that reports become systematic, a uniform case definition is recommended.

Methods

A revised case definition was developed through a variety of methods including a review of self-reporting surveys published in the peer-reviewed literature and other sources; interviews and correspondence with neighbours reporting health effects; incident reports posted on the Internet; testimony under oath during judiciary proceedings of neighbours reporting health effects; personal dialogue with physicians; and grey literature. We searched PubMed and Google Scholar for articles published since 2000 that included the terms 'wind turbine health', 'wind turbine survey', 'wind turbine symptoms', 'wind turbine self reports' and 'wind turbine noise'. A PubMed search with the search term 'case definition' obtained additional background relating to case definitions for emerging diagnostic challenges.

Guidelines for deployment of diagnostic criteria

The healthcare practitioner applying the criteria must be licensed to take a medical or health history and to make a diagnosis. Physicians should consider that children are also affected but in ways sufficiently different from adults. This will require a separate discussion.

The most frequent complaints or symptoms are sleep disturbances or difficulty initiating sleep and/or difficulty with sleep disruption and annoyance producing increased levels of stress and/or psychological distress. Another frequent complaint relates to inner ear symptoms.

The variation of terms of complaints should be understood in the context of people using

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many different words to describe similar health effects.[8]

Categories of diagnosis

1. Possible: a potential diagnosis is considered in the differential diagnosis.
2. Probable: cause of complaints is more likely than not related to adverse health effects in the environs of industrial wind turbines (AHE/IWT).
3. Presumed: no other explanation for the diagnosis of AHE/IWT can be found by history, physical and after appropriate investigations.
4. Confirmed: other diagnoses are very unlikely i.e. less than one chance in 20.

Probable diagnosis[7]

First-order criteria (all four of the following must be present)

(a) Domicile within up to 10 km from IWT.[9]
(b) Altered health status following the start-up of, or initial exposure to, and during the operation of IWT. There may be a latent period of up to six months.
(c) Amelioration of symptoms when more than 10 km from the environs of IWT.
(d) Recurrence of symptoms upon return to environs of IWT.

Second-order criteria (at least three of the following occur or worsen after the initiation of operation of IWT)

(a) Compromise of quality of life.
(b) Continuing sleep disturbance, difficulty initiating sleep and/or difficulty with sleep disruption.
(c) Annoyance producing increased levels of stress and/or psychological distress.
(d) Preference to leave residence temporarily or permanently for sleep and/or restoration.

Third-order criteria

Three or more of the following frequently occur or worsen following the initiation of IWT. If the symptoms described in second-order criteria (b and c) are present, no further symptoms or complaints are required for the probable diagnosis. Based on the authors' experience,[10] the following list provides an indication of the more common symptoms:

Neurological
(a) Tinnitus
(b) Dizziness
(c) Difficulties with balance
(d) Ear ache
(e) Nausea
(f) Headache
Cognitive
(a) Difficulty in concentrating
(b) Problems with recall or difficulties with recall
Cardiovascular
(a) Hypertension
(b) Palpitations
(c) Enlarged heart (cardiomegaly)
Psychological
(a) Mood disorder, i.e. depression and anxiety
(b) Frustration
(c) Feelings of distress
(d) Anger
Regulatory disorders
(a) Difficulty in diabetes control
(b) Onset of thyroid disorders or difficulty controlling hypo- or hyper-thyroidism
Systemic
(a) Fatigue
(b) Sleepiness[7]

Presumed diagnosis

If following a fulsome history, physical and completed investigations no alternative explanation is apparent, and the criteria of probable diagnosis have been met, then a presumed diagnosis of AHE/IWT is warranted. AHE/IWT exists until proven otherwise.

Proposed confirmed diagnosis

Sleep disruption

The confirmation of AHE/IWT could be achievable by the following methods:

- Simultaneous monitoring of physiological parameters, i.e. a sleep study as well as noise energy exposure which ideally should be done in the home of both affected and unaffected individuals with simultaneous recording of sound energy inside and outside the home while capturing all frequencies including decibel and infra- and low-frequency noise and sound pressure levels.

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- Blinding of the exposed individuals to control for visual impact is accomplished by testing during sleep.
- For sleep disturbance, measurements electrophysiologically[11] and by biomarkers.[12]

The complex physiological monitoring equipment required for a sleep study is not readily mobilised. Alternatively, sleep studies could be carried out in an established clinical sleep laboratory with a source of acoustic energy that accurately reflects the person's exposure to IWT.

Epidemiologic studies would be valuable to establishing the incidence and prevalence of AHE/IWT and have been recommended since 2006.[13] Schomer[14] comments that double-blinded studies could be done if industry co-operated by turning IWT off and on during noise energy and physiological measurements.

Differential diagnosis

An important differentiating point is the timing of the onset, and the impact of being away from home and the environs of IWT.

Significant improvement away from the environs of wind turbines and a revealed preference for sleeping away from home serve to distinguish between AHE/IWT from other conditions. One alternative explanation is a stressful home environment which might lead to restoration being more likely away from home. A history for family discord and other stressors should be elicited and ruled in or out.

Psychological issues and/or mood disorders may be simultaneously or independently present. If the situation appears more complex, then a referral to a clinical psychologist or psychiatrist might be considered.

Another possible consideration is chemical sensitivity or allergic reaction to contents in the home. The key differentiating feature would be the co-relation between the operation of IWT and symptoms. If the home is not a source of complaint or symptoms when IWT are not operating (see 'first-order criteria [b]' section), then chemical sensitivity or allergic response is highly unlikely.

Discussion

An earlier version of a case definition was published in August 2011[7] and has been cited in other publications.[15]

Research and other references have advanced the acknowledgement that symptoms are predictable[16] or can occur in some.[6,13,17–21]

Case definitions are frequently developed to assist with diagnosis of complex emerging issues. In some cases, establishing diagnostic criteria can be challenging[22,23] and can evolve over time.[24]

There are widespread reports of sleep disturbance in environs of IWT.[6,10,18] The WHO states 'Uninterrupted sleep is a prerequisite for good physiological and mental functioning...'[25]

Physiological monitoring employed in sleep studies of persons exposed to IWT are proposed to demonstrate measurable changes.[26] Quality of sleep, a 'prerequisite for good health'[27] can be measured objectively.

International reports of symptoms are consistent, and it is imperative that a systematic approach to diagnosis of AHE/IWT be adopted. The impacts can be significant resulting in many cases of people abandoning their homes temporarily or permanently.[4,5,17,21] Since Gohlke et al.[28] state: 'Wind energy will undoubtedly create noise, which increases stress, which in turn increases the risk of cardiovascular disease and cancer', home abandonment is a reasoned option.

This topic has been surrounded by competing claims and controversy[5,29–32] and has presented health professionals with management challenges. While the need for definitive evidence of the precise mechanism involved remains, with increased prevalence of wind energy facilities physicians can expect to see increasing numbers of rural patients reporting adverse effects.[17]

Conclusions

1. An updated version of the criteria for the diagnosis of AHE/IWT has been presented.
2. A change has been made in the third-order criteria which are commonly present but not necessary for a diagnosis to be made.
3. If the criteria for probable diagnosis are satisfied and investigation reveals no logical alternative to explain the health effects, a presumed diagnosis of AHE/IWT may be made.
4. A model for a study to establish a confirmed diagnosis has been proposed.

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