Review of Crichton et al (Can expectations produce symptoms from infrasound associated with wind turbines?)

Author: Punch, Jerry

Crichton, F, Dodd, G., Schmid, G., Gamble, G. & Petrie, K.J. (2013). Can expectations produce symptoms from infrasound associated with wind turbines? Health Psychology, Advance online publication. doi:10.1037/a0031760 [download]

The above-referenced study by Crichton et al. (2013) is open to criticism for its many methodological weaknesses. The most notable criticism is that their subjects were never actually exposed to infrasound. If the "studio woofer" was capable of producing a 5 Hz stimulus, they should have at least described or shown a graph of the output spectrum. Even if a true infrasound stimulus was produced by their equipment, 40 dB (presumably SPL) was not nearly sufficient to represent the level of infrasound in question by those who believe infrasound from wind turbines to be an issue. Even if a sufficient stimulus had been produced to represent wind turbine infrasound, a 10-min exposure would have been meaningless in representing the duration of exposure that is likely necessary to produce any substantial health symptoms. So the subjects were not actually exposed to any infrasound stimulation in the first place, in effect resulting in their being exposed only to two "sham" conditions.

The design itself limits the study's external validity and thus the ability to generalize the results to other populations and situations. First, most of the individuals who have reported adverse health effects from wind turbine noise, some of whom have abandoned their homes, are not people who were adequately warned of potential health effects prior to their exposures. In fact, many individuals who report adverse health effects were advocates of wind energy prior to being exposed. Because the major premise underlying this study is that people complain of wind turbine noise based primarily on expectancies that align with prior information, the study is based on a false premise. Furthermore, the use of university students does not represent the type of subjects who represent the population apt to complain about wind turbine noise. This population is probably the least vulnerable to the effects of wind turbine noise in that none were young or old, and few if any were likely to have chronic health conditions or to be disabled. Although the sample size may have been minimally sufficient, given the repeated-measures design, the distribution of male and female subjects should have been more equal. The extensive use of pretesting introduced reactive or interactive effects that could have affected posttest behaviors and ratings. Just the use of the laboratory setting and short exposure times, as opposed to a real-life setting in which wind turbine blades are turning at night and the subjects are inside a home, introduced situational effects that limit the ability to generalize the data. (The authors admit this shortcoming on p. 4 in their statement: "… exposure to infrasound in a listening room purpose built for sound experiments may not be directly comparable to exposure to infrasound from a wind farm".) Finally, multiple-treatment interference was likely operating, in that multiple treatment sessions and conditions were allowed to interact with each other in determining participants' performance on the dependent variables. Another design issue, or at least a reporting issue, is that the authors did not describe how their high-expectancy and low-expectancy conditions were managed in the experiment. Exposure sessions were described as counterbalanced, but were HE [high-expectancy] and LE [low-expectancy] conditions counterbalanced in an

interleaved fashion within exposure sessions, or were HE and LE conditions somehow performed in separate blocks? It is critical that readers understand whether and how subjects could be expected to sort out the different expectations across exposure trials throughout the course of the experiment. Even if HE and LE conditions were counterbalanced within exposure conditions, it is difficult to accept that extraneous variables were controlled to the same extent as they would have been if HE and LE conditions had been administered to separate groups of subjects, as opposed to the same subjects. The use of HE and LE conditions within the same subjects was probably a highly contaminating factor, even if the subjects had actually been exposed to both infrasound and sham conditions.

Basically, this was an experiment whose outcomes could have been predicted, given the conditions employed. As already stated, the outcome has virtually nothing to do with the real-world conditions of exposure to infrasound from wind turbines. In addition, it is well known that expectations can affect perceptions through top-down, or cognitive- based, processing, as opposed to bottom-up, or stimulus-based, processing. Examples of the effects of top-down processing (cited by Williams, 2007) include responses to visual stimuli, assessments of a person's ability, judgments of extended events, the enjoyment of a film, and cigarette preferences. Factors such as attention, effort, experience, experimental-demand effects, and adherence to self-image all can play a role in experiments designed to study perception, and none of these factors was controlled or discussed in this study.

In light of the above criticisms, a number of the authors' statements from the Results section are worth repeating, to illustrate my point that the findings were predictable:
(p. 3) "… change from baseline in the number of symptoms reported and the intensity of the symptoms experienced was not influenced by whether exposure was to sham or to infrasound."

(p. 3) "… results indicated the number of symptoms reported and the intensity of the symptom experienced during listening sessions were not affected by exposure to infrasound but were influenced by expectancy group allocation."

(p. 4) "Importantly, elevated symptom reporting seen in the high-expectancy group was the same during sham and infrasound exposure, confirming that infrasound exposure itself did not contribute to the symptomatic experience. No direct physiological effect of genuine infrasound exposure on heart rate or blood pressure was indicated …"

Finally, based on the many flaws in this study, I could not disagree more with the following statement by the authors (p. 5): "… this study suggests a promising future direction for further research". In my opinion, this study is merely a good example of junk science, and it is unfortunate that it was considered publishable in the journal H*ealth Psychology*. Hopefully, we can move beyond this type of experimentation and rely on genuinely scientific methods to uncover and define accurately and completely the linkages between wind turbine infrasound and adverse health effects.

About the author: As an audiologist, Jerry Punch, Ph.D., has over 40 years of professional experience as a clinician, clinical supervisor, clinic director, research director, university faculty member, and academic department chairperson. Audiologists are non-medical specialists with a master's or doctoral degree in the science of hearing and hearing loss, and

some audiologists, including Dr. Punch, have an interest in acoustics, psychoacoustics (how humans respond to sound), sound measurement, and community noise issues. Audiologists are neither medical specialists nor engineers, but serve as a bridge between the professions of otolaryngology and acoustic engineering. Dr. Punch has been interested in community noise for several decades, has taught a graduate-level course in Hearing Conservation at Michigan State University, and has provided expert testimony in legal cases involving occupational hearing loss. He has published approximately 80 articles in scientific and professional journals, and has served as an editorial reviewer for numerous scientific journals. More recently, he became interested in wind turbine noise as a community health issue after learning that two families had abandoned their homes because of sleep disturbance and other health symptoms that they believed were caused by the noise from nearby industrial-scale wind turbines in Huron County, Michigan. Subsequently, he co-authored a published review of the literature on wind turbine noise in the journal Audiology Today and chaired the Wind and Health Technical Work Group that was convened by the Michigan's Department of Energy, Labor, and Economic Growth in the spring of 2010. That work group was charged with revising the state's guideline for the siting of onshore industrial- scale wind turbines. After over 20 years in his faculty appointment in the Department of Communicative Sciences and Disorders at Michigan State University, Dr. Punch officially retired in May 2011, but remains active as a Professor Emeritus on MSU's Institutional Review Board and is a private consultant. He recently testified as a health expert in legal hearings on wind turbine noise in the states of Ohio and Wisconsin. In those cases, he argued that linkages between adverse health effects and wind turbine noise are supported by scientific evidence and that energy companies should be required to site turbines at setback distances that sufficiently protect residents from the harmful impacts of low-frequency sound and infrasound.