

Do negative expectations cause wind turbine health effects?

AEI analysis and commentary

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AEI lay summary of:

Simon Chapman, Alexis St. George, Karen Waller. 2013. **Spatio-temporal differences in the history of health and noise complaints about Australian wind farms: evidence for the psychogenic, “communicated disease” hypothesis.**

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Crichton, F., Dodd, G., Schmid, G., Gamble, G., & Petrie, K. J. (2013, March 11). **Can Expectations Produce Symptoms From Infrasound Associated With Wind Turbines?** *Health Psychology*. Advance online publication. doi: 10.1037/a0031760 [Read/download this paper \(Scribd\)](#)

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If the detail provided here is more than you can tackle, I encourage you to read the final few paragraphs, which look beyond these two particular studies and reflect on the health effects issue and its role in the larger debate over wind farm siting.

During 2013, AEI’s work on wind farm noise issues will be focusing on a couple of fundamental themes. The first is beginning here, as I start familiarizing myself with literature that investigates some of the psychological research in public health; such factors are likely in play around wind farms, as they are in nearly any health or public opinion issue. The second theme AEI will be digging into this year is inflow turbulence, and what its contribution may be to the noise issues around wind farms.

In Australia, the debate about wind farm siting standards has ramped up beyond what we’ve seen in the US and Canada. Several states have adopted more [precautionary setbacks](#) (2km, with some options for closer siting), and this has spurred some pushback from wind energy advocates. Meanwhile, the Waubra Foundation has become a central repository for information on negative impacts, and has released a series of reports and [statements highlighting health effects](#) and home abandonments, while calling for an even more precautionary 10km setback standard.

Recently, two reports were released in Australia that have garnered worldwide attention for their claim that health effects around wind farms are caused primarily by negative expectations promulgated via the web and local chapters of groups such as Waubra. One of these is a formal study published in the journal *Health Psychology* by a team from the University of Auckland, and the other is the latest (and most comprehensive) paper from Simon Chapman, a University of Sydney Professor of Public Health and outspoken skeptic about wind farm health claims.

I’ve long been concerned that the adamantly contradictory statements of both wind advocates and concerned citizens groups are likely to be inadvertently [contributing to](#)

anxiety and stress among wind farm neighbors, which could well be a major contributor to many of the most widespread health effects (especially headaches and sleep troubles). These new papers are investigating plausible psychological factors, and both studies add some useful new insights; however, similar to my assessment of a recent peer-reviewed article touted as proof of health effects, digging into these two papers reveals data that is far less clear-cut and absolute than the conclusions drawn by the researchers, and especially as reflected in the simplified popular press accounts of the studies.

The short version of my assessment of these papers:

The Chapman paper gathers a wealth of information about complaint rates around all the wind farms in Australia, and taken at face value, makes an apparently convincing case for Chapman's preferred hypothesis about the differences he finds: that the presence of local and national groups harping on possible health effects is the proximate cause of health complaints, and indeed, for the actual appearance of the symptoms themselves among wind farm neighbors. But Chapman's insistence that the negative influence of "anti wind farm groups" can totally explain away all the noise problems is ludicrous. His paper frames all his data through this one lens, and makes no effort to consider other possible contributors to the differences he finds in complaint levels. At the same time, his inclusion of existing public health research on the nocebo effect and studies of psychologically-mediated responses to perceived environmental threats is a welcome addition to our consideration of wind farm noise issues; still, as I begin to dig into the actual academic studies that he cites, they seem to be at best suggestive of modest contributing factors, rather than offering data that's strong enough to be posited as the sole or primary explanations for most noise complaints.

For example, the Crichton paper finds that expectations of negative health effects can create a statistically significant increase in the number and severity of symptoms reported by study subjects exposed to infrasound (and to sham infrasound). However, the actual data shows only moderate changes in reported health responses, especially in symptom severity, rather than a dramatic difference between the subjects primed with negative expectations and those who were given reassuring information prior to exposure to the sounds. The average severity of symptoms, rated on a scale of 0-6, averaged 1.67 for the group primed to expect no health effects, and an only slightly higher 1.94-2.13 among those primed to expect negative impacts—a far cry from the intolerable responses being reported by some wind farm neighbors.

Despite the fact that these papers don't contain a "smoking gun" that explains away negative health effects, as wind advocates may be claiming, their findings can be seen as a likely *part* of the story. The small differences found in the Crichton study may be due to averaging over all participants; perhaps some individuals responded more dramatically than her data shows; a stronger effect on some individuals could be embedded in the similarly subtle yet statistically significant trends in the Nissenbaum study that found worse sleep and psychological health among those closer to wind farms. And the Chapman paper reminds us that those reporting health effects remain a small minority, even in areas with substantial community outcry. As AEI has often mentioned, even empathetic researchers tend to suggest that significant health effects occur in only 5-10% of the nearby population; as discussed below, a divide is emerging between those

who feel that such small numbers reflect insignificant impacts, and those who feel that we can and should avoid or better minimize such effects by increasing setbacks.

Before delving into a more comprehensive analysis of these two papers, I want to note that it feels a bit odd to be in the position of “defending” health effects claims, though the comments below will often be pointing out ways that these papers are less successful than they’ve been touted to be in explaining the sources of symptoms being experienced by wind farm neighbors. Some valuable, and perhaps necessary, perspective on what follows may be provided by outlining my current view on this hot-button issue. It’s an odd blend of viewpoints, but one that I think avoids the tendency on both sides for dogmatic thinking, and allows us to approach the question with both discernment and an open mind and heart.

**Health effects: real but rare,
deserving of compassion and research but (so far) a weak basis for policy-making**

As stressed in AEI’s 2012 and 2011 [annual reports](#) on wind farm noise issues, I think that the health effects argument is a terrible place to hang one’s hat if the goal is to encourage larger setbacks from homes. There are many valid reasons that rural communities might choose—as some indeed have—to establish setbacks large enough to make turbines less audible at homes: sense of place, quality of life, landscape/aesthetic considerations, and a simple desire to not live with chronic, moderate, audible noise from wind turbines. It will be years before epidemiological studies can investigate, let alone prove or disprove, a causal link between turbine proximity and any health effects; in any case, physical or psychological symptoms seem to occur in a relatively small proportion of the nearby population (perhaps as much as 10%); a significant minority, up to half of those close enough to hear turbines regularly, often finds the noise bothersome, though not triggering any health effects. It is the voice of this 20-50% of nearby neighbors who simply don’t want to live with turbine noise that is being shunted aside by arguments based on the more severe reactions of the 5-10% reporting significant health effects. Everyone’s devoting way too much energy and attention trying to prove or disprove the existence and causes of the few extreme health effects, and far too little devising flexible, adaptable siting practices that could allow wind development to continue to expand while accommodating the clear variability in noise tolerance among different types of communities.

More to the point of these studies, I can easily accept the idea that the negative experiences being highlighted by community groups are indeed one of several factors that increase the anxiety and stress levels of residents, which may itself cause many of the symptoms reported, as well as fostering negative expectations, which has been recognized and studied as a contributing factor in public health for years. In addition, like many observers, I’m unconvinced that Wind Turbine Syndrome is a clinically or epidemiologically credible disorder or complex of symptoms. It appears that the vast majority of health symptoms are related to stress and sleep-disruption (stemming directly or indirectly from the presence of wind turbines), while a few may be due to unusually intrusive sound qualities in particular locations, or specific susceptibility factors (extreme auditory acuity, noise sensitivity, pre-existing vestibular issues, perhaps other psychological factors). That is, I don’t

see clear evidence that wind turbines inherently “make people sick,” though they certainly can disturb sleep, and it seems apparent that dealing with their varied and sometimes intrusive noise can trigger a cascade of direct and indirect effects that may result in psychological and/or physiological symptoms.

I’m also comfortable acknowledging that conventional wisdom continues to hold that turbine infrasound is well below the levels shown to cause human health problems in factories or fighter jets, and I remain far more interested in the annoyance, stress, and sleep-disruption effects of audible low-frequency sound around wind farms, especially at distances beyond a half mile, at which point higher and mid frequencies have largely been absorbed, leaving a predominantly low-frequency sound spectrum at many homes.

At the same time, though, I’m closely following several leading-edge—or, from another perspective, still preliminary—lines of research that, if replicated and expanded upon, may provide the foundation for a more credible understanding of some of the health effects being reported. Using sensitive recording equipment and short time-filtering (similar to human auditory response times), two teams of acousticians have found rapid fluctuations and high peaks in dBG levels (sound in the frequency range around the threshold between audible low frequency and infrasound) in some homes where residents have been particularly affected. This work, along with auditory physiology studies suggesting that a sound-dampening system in our ear’s outer hair cells may respond to infrasound at lower levels than is perceptible, is provocative and important, as it could suggest that turbine infrasound and low-frequency noise is more perceptible than typical hearing curves (based on steady pure tones) have assumed. In addition, as turbines blades get longer, they’re producing more low-frequency and infrasound, and the timing of the pulses of sound is slowing, moving down toward a rhythm that may be associated with triggering nausea. These lines of research deserve further investigation, so the implications can be either verified or disproved and we get a better sense of how common and relevant such effects may be.

And finally, as regular readers know (again, see the annual reports linked above, especially for 2012), the time I’ve spent with wind farm neighbors leads me to generally accept their reported symptoms at face value; there’s little sense that their experiences have been unduly influenced by others. *(It’s crucial to separate the experiences of actual wind farm neighbors, which are often quite nuanced and detailed, from the more generalized fears of people in places where wind farms have only been proposed.)* Most of those I’ve met, and indeed most of those widely quoted in online media, did not begin with negative expectations; by and large, they were told they wouldn’t hear the turbines, and many were excited about the green energy contributions being made by their communities. Their later responses were caused by the unexpectedly intrusive nature of the audible turbine noise at their homes, which is indeed more of an issue than was widely recognized even three or four years ago. Yes, it’s entirely possible that the growing wave of complaints from around the world have reinforced, accentuated, or sensitized some of them to be more upset about both what they experience at their homes and the unsympathetic responses they get from wind farm operators, as well as from others living further

away in their own communities; in a few cases, the their own daily and weekly experiences, compounded by frustrations caused by a long struggle to reclaim their lost sense of home, is likely contributing to chronic stress that makes it all worse. But it's clear to me that the widespread noise annoyance, and the less common severe sleep and other health issues, that these wind farm neighbors are living with were not fundamentally or primarily *caused by* what they read online or heard from others. It was the turbines, and their noise, that changed their lives.

I realize being transparent about all this may lead some to presume that I am not objective enough to be trusted; yet my relatively skeptical reading of the "proof-of-health-effects" literature, along with my acknowledgement that psychological factors do play a role and my consistent efforts to clarify the proportion of neighbors actually affected may counter such concerns.

OK, with that said, let's take a look at these two new papers.

Simon Chapman, Alexis St. George, Karen Waller. 2013. Spatio-temporal differences in the history of health and noise complaints about Australian wind farms: evidence for the psychogenic, "communicated disease" hypothesis. (Pre-print; submitted for publication)

Chapman and his colleagues have compiled a wealth of information about known health and noise complaints around all 49 wind farms operating in Australia over the past twenty years. His primary results are indeed eye-opening: that only about 120 individuals across the country have publicly complained about turbine noise or health (by filing formal complaints with the company or government agencies, or being quoted in the press), with 80% of these occurring after 2009, "when anti wind farm groups began to add health concerns to their wider opposition." Only half of 34 Australian wind farms with turbines over 1MW have triggered any complaints at all, and two-thirds of the complaints have occurred at just five wind farms "which have been heavily targeted by anti wind farm groups." (*Ed. note: we find possible concurrence with Chapman's numbers in public statements of the Waubra Foundation, which also note that its staffers have documented and spoken to "over 100 individuals" with health issues which they attribute to the turbines.*)

One of Chapman's underlying principles is that widespread publicity of the few negative reports has created "insurmountable problems" for research on health effects of turbines, since most of the population has presumably been exposed to information that will now and forever distort their self-reported experiences. Therefore, he posits that we must look to historical records of complaints to determine what the actual reactions to wind farms were, before the introduction of the negative programming. Finding relatively few complaints in years prior to publicizing of health effects, or in wind farms where there are no active community groups raising concerns, he therefore sees affirmation of his primary hypothesis: that reported health effects are primarily the result of psychological factors, not the turbine noise itself.

While granting that nocebo effects *are* recognized as a factor in public health, it must be pointed out that rarely are they a predominant factor, and that public health researchers can and do continue to fruitfully study conditions in which nocebo, placebo, actual

exposure levels, and countless other compounding factors (physical and psychological) are in play.

Chapman also seems intent on the idea that public complaints reflect the full extent of any responses to the presence of wind turbines. While I understand the desire to base his conclusions on the most solid, objective measure possible, the fact is that his data can only be considered a record of complaints—a slew of confounding factors prevents us from presuming that all those affected by noise are accounted for in the complaint records, either now or in the past records.

In particular, it's not at all surprising that complaints tend to compound when local citizens begin talking publicly about their problems, or even when they hear that others elsewhere are having similar problems (whether sleep disruption, more acute symptoms, or “simply” annoyance or displeasure about having to live with audible turbine noise). It's entirely plausible that people are more apt to feel that it's worth it (or find it socially more acceptable) to voice complaints if there is an active local movement of some kind to be a part of. Speaking up on your own can feel futile, or can feel like sticking your neck out publicly. Especially if there are relatively few people in any given area having serious problems, it's natural that few would want to speak up until there was some company and social support for voicing their concerns. Once a few people do break the ice, others are likely to speak up as well (especially those who are less seriously affected, but still upset about the change in local sense of place or quality of life). This is not necessarily, or even likely, a reflection of Chapman's presumed “psychogenic” or “communicated disease” effect: the idea that public discussion of negative impacts actually *creates* nocebo-infected experiences in the population, thus leading to the emergence of complaints. While there are likely several psychological factors in play (especially in regards to the personality types that are most comfortable complaining or speaking in public), it's also quite natural that many people are reticent to be perceived as a lone complainer, especially in small towns.

These initial comments are indicative of the larger conceptual shortcomings of Chapman's analysis: he's too intent on linking all his data to a single, simple explanation of the causation; he simply doesn't evaluate any other possible contributing factors, to complaint rates or actual noise annoyance or health effects. As Wayne Gulden also points out, Chapman's paper makes a good case for the *plausibility* of a nocebo effect, but doesn't marshal the necessary evidence to prove that it's the primary cause of complaints.

These larger conceptual shortfalls include two in particular.

The first affects his discussion of why half of Australian wind farms have generated no formal complaints. In particular, Chapman stresses that the state of Western Australia has 13 wind farms, none of which have generated complaints. One obvious question is whether there are any geographical or sociological factors that may distinguish the regions with more complaints from those with less. These could include difference in place identity (working farmers and ranchers tend to consider turbines part of a working landscape, whereas those living in the country but not working the land tend to find turbines more intrusive), or population density within typical audible distances, or topographical factors (wide open plains tend to lead to turbine noise that's more

consistent and more apt to be masked by wind hitting houses, whereas turbines in rolling country or on ridges can lead to more varied turbine noise, and more audibility in houses sheltered from winds). Chapman fails to consider such possibilities, other than a partial look at the population density question (Gulden more helpfully provides some Google Maps images of disparate locations).

Looking past complaint rates, toward the more fundamental question what may be contributing to the reported health effects, Chapman is similarly single-minded. His overly narrow focus is highlighted in the initial frame he imposes, positing that there are but two “broad hypotheses” about those reporting symptoms around wind farms: his psychogenic/nocebo hypothesis, and the idea that turbine noise (audible and infrasound) is directly harmful to our health. While direct exposure to turbine sounds is a fear that’s in play in the public imagination, a third “hypothesis” is much more widely discussed and studied: the supposition that many or most of the reported health effects are caused by or associated with sleep disruption and stress—via occasional or chronic annoyance—in response to audible noise from turbines. The likely central role of stress in the chain of causation includes a range of contributors, one of which is indeed Chapman’s preferred Sole Answer: stress induced by fears of negative effects heard from concerned citizen’s groups. Other widely recognized sources of stress among wind farm neighbors include: stress/anxiety in response to changes in one’s local landscape, especially if the changes are not in one’s control; simple stress response to audible noise in the environment, especially the unusual variability of turbine noise and its hard-to-ignore pulsing quality; anger at having one’s experiences denied or not believed; and stress from community (and sometimes familial) discord about the wind farm. In addition to stress factors, another likely widespread contributor to health effects symptoms is generalized noise sensitivity, which affects about 20% of the population and often includes being more susceptible to waking and arousals during sleep in response to low or moderate noise. Other possible contributors are individual characteristics such as susceptibility to motion sickness, pre-existing vestibular problems, being on the more sensitive fringe of the human auditory acuity curve, or tending toward depression or other psychologically vulnerable conditions. Obviously, we can’t expect any single study to untangle all of these contributing factors, but by framing his “two hypotheses” to completely omit acknowledgement that any of this is even on the radar, Chapman doesn’t just stack the deck, but deals his hand using only two of the suits.

A couple final observations on Chapman’s assumptions:

While stressing the pervasive impact of negative expectations about turbine noise caused by public statements of local community activist groups or read online, Chapman ignores the fact that the public is also exposed to a steady diet of studies, news reports, and statements in meetings which reassure the public that there is absolutely no evidence that wind farms can cause any health problems, and stress the fact that there are tens or hundreds of thousands of people living around turbines who are not getting sick. To the degree that negative “messaging” may have negative psychogenic effects, so too should positive messaging calm the concerns of the population.

My last quibble with Chapman’s paper actually leads to a point of agreement. This has to do with his use of numbers, which distort the rates of complaints. In his introductory

look at previous research, Chapman repeats an oft-quoted result from the famous Scandinavian studies that under 10% of people around wind farms report even annoyance, let alone health effects. This reflects a common methodological underestimate, by including people who live too far away to hear turbines in the full population being considered. Indeed, the well-designed Scandinavian studies (still our only totally reliable community response surveys) found that just 9% of respondents expressed moderate or extreme noise annoyance. These numbers include people out of earshot of turbines, and populations in both rural and suburban areas. Digging deeper, we find that even these older, smaller turbines triggered significant annoyance in 15% of those who could actually hear turbines, and 22% of those who could hear them in rural settings. Still, these annoyance rates did not imply a constant plague: only half were bothered inside their homes, and just a third or less (ie just 7% or less) reported any physical or health effects, including sleep disruption.

Chapman's Australian data shows that under 1% of those living within 5km turbines over 1MW in size have ever formally complained, again using a large radius of potential impact to cook the books to suggest annoyance is insignificantly rare. In this case, he's responding in part to Waubra's call for 10km setbacks; even a couple of government inquiries have looked out as far as 5km. But in practice, in most (though not all) situations, it's rare for turbine noise to trigger extreme responses beyond around 2km. It's impossible to know from Chapman's paper how many complaints came from within 2km, though likely most did. A rough (and speculative¹) adjustment of his figures to consider a radius of 2km (resulting in an area of interest with one-sixth the area of a 5km radius) could suggest that rather than 1 in 107 lodging complaints, as many as 1 in 18 in this closer zone, or over 5%, may be affected (and bearing in mind that formal complaints never tell the whole extent of impact).

While his proportional representation is misleading, I do see Chapman's study as another in a fairly consistent body of research and public comments by a wide range of observers that reminds us that health effects are relatively rare around wind farms. As noted above, even Waubra's total of formal reports more or less matches Chapman's collection of public complaints. Based on several surveys, as noted above and below, it seems clear that those reporting health effects represent a small proportion of residents who dislike and are struggling to adjust to the presence of turbine noise in and around their homes. While I find Chapman's overall numbers to be a contribution to our understanding of wind farm health complaints, his single-minded devotion to his preferred explanation of *why* people complain leaves much to be desired.

An important note on all these numbers and proportions: It's very hard to know how many people are bothered and not complaining; Chapman and other wind advocates rely on formal complaints as the ultimate number, and often further consider many of these complaints to be unreliable, while some community groups presume or imply that there are vast numbers of "quietly suffering" people who never speak up. There are only a very few useful surveys of community responses to local wind farms; this should be a high research priority, in a variety of types of communities. **Interestingly, one of the**

¹ This exercise assumes that population density is roughly the same in the closer 2km zone as it is in the larger 5km zone, and that all of the complaints occur in the 2km zone. While it's likely that neither of these assumptions is precisely accurate, the underlying point is almost surely correct: a much higher proportion of those who hear turbines regularly are being bothered, than of those who hear turbines only rarely.

Australian wind farms considered here, Waterloo, has been the site of three community surveys, all of which suggest more noise annoyance than reflected in the formal complaint records. Chapman's diligent, three-pronged search of public complaints showed 11 people bothered by noise or health effects in this area; two surveys of 75 homes within 5km reported at least 23 respondents who were "very" or "moderately" annoyed by sound, and 13 reporting health effects, primarily sleep disruption and headaches (18% of households within 5km). More striking is a survey by TRUenergy, the owner of the wind farm, which sampled 358 people in a larger area around the wind farm, and found almost 90 people, or 25% of the sample, reported noise to be an issue, by far the biggest negative attribute; only 10% disliked how they looked. *(Waterloo is also interesting in that the turbines are over 3km from most of the residents of the village. While there are other locations where distant homeowners have had problems, Waterloo appears to have an unusually high concentration of more distant complaints. If there is something particular about the terrain or wind conditions there that contributes to noise levels remaining high over greater distances, that would be good to know, to avoid similar situations elsewhere.)*

For more on these and the few other community response surveys, including consideration of their academic rigor, see AEI's 2012 Wind Farm Noise annual report.

Crichton, F., Dodd, G., Schmid, G., Gamble, G., & Petrie, K. J. (2013, March 11). Can Expectations Produce Symptoms From Infrasound Associated With Wind Turbines? Health Psychology. Advance online publication. doi: 10.1037/a0031760

This was a very interesting study design, which came up with some provocative results. Two groups of test subjects were exposed to 10 minutes of infrasound and 10 minutes of "sham infrasound" (i.e., they were told that inaudible infrasound was being played back, but in fact it was not). Each test group watched a 5-minute video prior to their session; the high-expectancy (HE) group saw TV footage of first-person accounts of health effects attributed to the operation of nearby wind turbines, while the low-expectancy (LE) group saw interviews with experts stating the scientific position that infrasound produced by wind farms would not cause any health symptoms.

Participants rated their experience of symptoms both before and during the real and sham infrasound exposures. Twenty-four symptoms were included on the reporting sheets, twelve that are commonly reported in association with purported infrasound exposure (headache, ear pressure, ringing in the ears, itchy skin, sinus pressure or irritation, dizziness, pressure in the chest, vibrations within the body, racing heart, nausea, tiredness, feeling faint) and twelve less typical infrasound-related symptoms (stomach ache, aching legs, aching arms, sore joints, stiff muscles, back pain, numbness or tingling in the body, difficulty swallowing, sore jaw, chills, hot flushes, hand tremble or shake). Each symptom was rated by test subjects on an intensity scale of 0-6.

The results as reported in the paper (and in the press and by Chapman) are certainly attention-getting: the HE group reported significantly more symptoms, and rated them as significantly more extreme, than the LE group. More typical symptoms (i.e., more apt to have been mentioned in the videos) were reported more often than symptoms that weren't mentioned. And most strikingly, the HE group showed nearly as big an increase in symptoms and intensity during sham infrasound as during the real thing. Yikes—

sounds like a clear smoking gun that all those people saying that their lives are in shambles due to infrasound exposure must be fooling themselves, eh?

Well, maybe, maybe not. It turns out that when I dug into the actual reported data, the effects are pretty subtle. As mentioned above, it reminded me a great deal of the Nissenbaum, Arami, Hanning study of sleep and psychological health ratings in Vinalhaven and Mars Hill, Maine: small shifts in overall averages, but far short of “proving” a causal relation, and far less dramatic change than what neighbors report. Several things play into my overall reaction to the Crichton study as offering, like the Nissenbaum one, important new insights without being as game-changing as it’s been made out to be.

First, the change in the number of reported symptoms is modest. All subjects (HE and LE) reported a baseline of 6 symptoms before any exposures took place (The results are all presented as averages, so we don’t know if any particular symptoms tended to be more common in any of the test groups or conditions). The HE group reported an average of 9 symptoms during infrasound exposure, and 8 during sham exposure; 15 other symptoms were not triggered (the HE group experienced an average of 5 of the 12 common symptoms; over half were not triggered). Clearly, the HE video of health horror stories didn’t cause a huge uptick in symptoms.

More striking are the ratings of symptom intensity—the difference between the groups is nearly imperceptible. Rather than reporting average symptom-severity ratings from 0-6, the authors reported this data by presenting the average *total* of each participant’s symptom ratings across all symptoms reported; this makes some logical sense as a measure of total discomfort, and it also produces a more dramatic-looking graph that runs from 0-25; actual averages among the test conditions and groups range from 9 to 17.5, showing statistically significant higher totals among the HE group during both real and sham infrasound, as compared to both their own “before” totals and the “during” totals of the LE group.

But: remember that these totals are spread over all 6 or 8 or 9 symptoms being reported. It turns out that the average baseline rating of both HE and LE groups prior to any exposure trials was 1.67 on that 0-6 intensity scale: they were noticing these symptoms, but not too much past just noticeable. As expected, the LE group showed no increase during exposures. And, as reported, the HE group did respond to both real and sham exposures by reporting worsening of symptoms: their average intensity rating went all the way from 1.67 to 1.94-2.13!! Yowza, sounds like they’re just being tormented by that infrasound and pretend infrasound, doesn’t it? The most extreme way to look at the HE group’s symptomatic responses would be if the entire increase in total severity scores (from a total of 10 across 6 symptoms to a total of 17.5 over 9 symptoms) was chalked up to the new symptoms only: and in this case, the average reported intensity of the 3 new symptoms is a whopping 2.5.

Overall, it seems to me that the study showed that expectations are likely one potential influence toward experiencing symptoms—which is not surprising in the least, as it’s commonly recognized as a factor in public health. But these results appear to be far from “proof” that expectation created a broad range of new, or subjectively severe, symptoms.

It surely would be interesting, and potentially valuable, to see a distribution of what symptoms were actually reported with the most frequency, both at normal baseline for everyone, and especially within the HE group. I wonder whether a few individuals (say, 5-10% ??) responded significantly more dramatically than most, with this signal being lost in the averages; this would make a far better case for expectations playing a major role in the real-world reported health effects, than do these very small changes in overall averages. And, this study only tracks a very immediate effect of expectation, less than an hour after seeing a single 5-minute video; it's certainly plausible, even likely, that the subtle effects seen here could become larger over time, especially among those who immerse themselves in online research on health effects.

At the same time, though, as with the Chapman study, we must remember that in the general population, the "low-expectancy" message is also widely disseminated. However strong a role expectation may play, both HE and LE factors are likely to be involved. And, in the real world (as compared to this short-term lab study), expectation is clearly not the only factor involved in reported health effects: stress in all its sources (as listed above), noise sensitivity, and various psychological factors can all play into it. In any case, the severity of symptoms reported here would have to increase dramatically to begin to match those reported by the minority of wind farm neighbors who are most affected.

One final note on this study: the infrasound exposure source was a 5Hz tone at 40dB. This is so low a volume that it could also be considered a sham signal; typical human perception curves suggest infrasound must be over 100dB at 5Hz to be perceptible, and no symptoms are expected unless exposure is over that level. Wind turbine sound at 5Hz tends to be in the 65-70dB range at typical home distances.

Getting to the deeper questions

It's disappointing that public dialogue over wind farm siting has devolved to the point that both sides are trapped in a sorry game of scientific tetherball: each tiny team slapping interesting but limited studies around the pole, touting them as definitive proof that wind farms do or don't "make people sick," while the vast majority of citizens and decision-makers wonder what their fascination is with that ball on a rope.

Certainly, for those upset at current siting standards, the worst-case health impact scenarios are heartbreaking, and appear to offer a more "valid" reason to make some changes, one more convincing than a simple local desire to not hear wind turbines. And so wind proponents are left with little choice but to try to "disprove" the health claims. Meanwhile, though, a broader discussion, one that's more directly relevant to the surrounding population as a whole, is being neglected; the tetherball match is occupying everyone's time and attention.

I generally agree with Chapman (and many other observers from all sides of the debate) that health effects are relatively rare. For me, it's the audible noise itself in the local landscape that's the primary issue; and this is the basis on which each community should make its own determination of how much noise they feel is appropriate. Responses to any noise, and to any change in a community, will always involve some psychological, personality, and sensitivity elements, in addition to whatever the concrete, measurable

impacts may be; we don't need to either deny or exaggerate the role of these more personal, subjective aspects of the issue.

IF THE POINT of Chapman's work is to make the case that problems are so rare that we shouldn't worry about them, then make that explicit....rather than try to extend the data to imply *all* the complaints are *only* due to placebo. But he and other wind advocates will still need to grapple with the valid voices of those who are calling for more stringent standards for audible noise, or making a case for landscape aesthetics.

SIMILARLY, IF THE GOAL of community groups is to adopt siting standards that reduce or avoid extreme negative experiences for 5% of the nearby population, and noise-related degradation of quality of life/place/home on 25-50% of close residents, then make that explicit....rather than trying to extend the data to imply that health effects are widespread and inevitable for most nearby residents. But they'll need to be ready to join in building a community consensus about where noise impacts really do diminish to tolerable or insignificant levels, knowing that a "zero-impact" standard is rarely attained (though the choice may certainly be on the table).

And everyone will need to be clear about the differences between noise questions, the visual/aesthetic issue, and fundamental disagreements about renewable energy in general. All of these are legitimate discussions to have, but neither those in favor of free-wheeling wind development nor those wanting to limit or stop it in its tracks can expect the health effects tetherball match to be the deciding factor. Larger questions deserve to be getting more of the attention in county commission meetings, state and federal agency research and policy discussions, and the wind industry's roadmap to the future.

A key dividing line occurs over the question of whether the observed effects on nearby neighbors or much-loved local landscapes is even worth considering. Some (especially those being affected) believe all such impacts should be avoided, while others accept that there will always be tradeoffs (though these tend to affect people other than themselves). Do wider social and ecological benefits justify local costs? If so, is compensation of some kind warranted?

Is it "worth it" to use larger setbacks, and thus somewhat limit wind development options, in order to minimize or avoid these impacts? 1km setbacks would reduce the incidence and severity of problems to some degree, 1.5km would avoid most of the severe neighborhood impacts, and 2km would make even mildly negative responses quite uncommon. Since half the population is relatively noise tolerant, it's likely that noise easements could reduce these distances in many cases. Can the wind industry adopt a variety of siting guidelines that reflect the variability in community tolerance for noise at homes or 40-story turbines in proximity to favored landscapes?

These are the questions that remain at the heart of the controversies over wind farm siting.

These are the discussions we should be having.