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(Received 19 March 2015; revised 7 July 2015; accepted 20 November 2015; published online 31 March 2016)

Health Canada, in collaboration with Statistics Canada, and other external experts, conducted the Community Noise and Health Study to better understand the impacts of wind turbine noise (WTN) on health and well-being. A cross-sectional epidemiological study was carried out between May and September 2013 in southwestern Ontario and Prince Edward Island on 1238 randomly selected participants (606 males, 632 females) aged 18–79 years, living between 0.25 and 11.22 km from operational wind turbines. Calculated outdoor WTN levels at the dwelling reached 46 dBA. Response rate was 78.9% and did not significantly differ across sample strata. Self-reported health effects (e.g., migraines, tinnitus, dizziness, etc.), sleep disturbance, sleep disorders, quality of life, and perceived stress were not related to WTN levels. Visual and auditory perception of wind turbines as reported by respondents increased significantly with increasing WTN levels as did high annoyance toward several wind turbine features, including the following: noise, blinking lights, shadow flicker, visual impacts, and vibrations. Concern for physical safety and closing bedroom windows to reduce WTN during sleep also increased with increasing WTN levels. Other sample characteristics are discussed in relation to WTN levels. Beyond annoyance, results do not support an association between exposure to WTN up to 46 dBA and the evaluated health-related endpoints.

[http://dx.doi.org/10.1121/1.4942391]

[SF] Pages: 1443–1454

I. INTRODUCTION

Jurisdiction for the regulation of noise is shared across many levels of government in Canada. As the federal department of health, Health Canada's mandate with respect to wind power includes providing science-based advice, upon request, to federal departments, provinces, territories and other stakeholders regarding the potential impacts of wind turbine noise (WTN) on community health and well-being. Provinces and territories, through the legislation they have enacted, make decisions in relation to areas including installation, placement, sound levels, and mitigation measures for wind turbines. In July 2012, Health Canada announced its

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intention to undertake a large scale epidemiological study in collaboration with Statistics Canada entitled Community Noise and Health Study (CNHS). Statistics Canada is the federal government department responsible for producing statistics relevant to Canadians.

In comparison to the scientific literature that exists for other sources of environmental noise, there are few original peer-reviewed field studies that have investigated the community response to modern wind turbines. The studies that have been conducted to date differ substantially in terms of their design and evaluated endpoints (Krogh *et al.*, 2011; Mroczek *et al.*, 2012; Mroczek *et al.*, 2015; Nissenbaum *et al.*, 2012; Pawlaczyk-Łuszczyńska *et al.*, 2014; Pedersen and Persson Waye, 2004, 2007; Pedersen *et al.*, 2009; Shepherd *et al.*, 2011; Tachibana *et al.*, 2012; Tachibana *et al.*, 2014; Kuwano *et al.*, 2014). Common features among these studies include reliance upon self-reported endpoints, modeled WTN exposure and/or proximity to wind turbines as the explanatory variable for the observed community response.

There are numerous health symptoms attributed to WTN exposure including, but not limited to, cardiovascular effects, vertigo, tinnitus, anxiety, depression, migraines, sleep disturbance, and annoyance. Health effects and exposure to WTN have been subjected to several reviews and the general consensus to emerge to date is that the most robust evidence is for an association between exposure to WTN and community annoyance with inconsistent support observed for subjective sleep disturbance (Bakker *et al.*, 2012; Council of Canadian Academies, 2015; Knopper *et al.*, 2014; MassDEP MDPH, 2012; McCunney *et al.*, 2014; Merlin *et al.*, 2014; Pedersen, 2011).

The current analysis provides an account of the sample demographics, response rates, and observed prevalence rates for the various self-reported measures as a function of the outdoor WTN levels calculated in the CNHS.

II. METHOD

A. Sample design

Factors considered in the determination of the study sample size, including statistical power, have been described by Michaud *et al.* (2013), Michaud *et al.* (2016b), and Feder *et al.* (2015). The target population consisted of adults, aged 18 to 79 years, living in communities within approximately 10 km of a wind turbine in southwestern Ontario (ON) and Prince Edward Island (PEI). Selected areas in both provinces were characterized by flat lands with rural/semi-rural type environments. Prior to field work, a list of addresses (i.e., potential dwellings) was developed by Statistics Canada. The list consists mostly of dwellings, but it can include industrial facilities, churches, demolished/vacant dwellings, etc. (i.e., non-dwellings), that would be classified as out-of-scope for the purposes of the CNHS. The ON and PEI sampling areas included 315 and 84 wind turbines, respectively. Wind turbine electrical power output ranged between 660 kW to 3 MW (average 2.0 ± 0.4 MW). All turbines were modern design with 3 pitch controlled rotor blades (∼80 m diameter) upwind of the tower, and predominantly 80 m hub heights. This study was approved by the Health Canada and Public Health Agency of Canada Research Ethics Board (Protocols #2012–0065 and #2012–0072).

B. Wind turbine sound pressure levels at dwellings

A detailed description of the approach applied to sound pressure level modeling [including background nighttime sound pressure (BNTS) levels] is presented separately (Keith *et al.*, 2016b). Briefly, sound pressure levels were estimated at each dwelling using both ISO (1993) and ISO (1996) as incorporated in the commercial software CadnaA version 4.4 (Datakustik, 2014). The calculations were based on manufacturers' octave band sound power spectra at 10 m height, 8 m/s wind speed for favorable propagation conditions (Keith *et al.*, 2016a). As described in detail by Keith *et al.* (2016b), BNTS levels were calculated following provincial noise regulations for Alberta, Canada (Alberta Utilities Commission, 2013). With this approach BNTS levels can range between 35 dBA to 51 dBA. The possibility that BNTS levels due to highway road traffic noise exposure may exceed the level estimated by Alberta regulations was considered. Where the upper limits of this approach were exceeded (i.e., 51 dB), nighttime levels were derived using the US Traffic Noise Model (United States Department of Transportation, 1998) module in the CadnaA software.

Low frequency noise was estimated in the CNHS by calculating outdoor C-weighted sound pressure levels at all dwellings. There was no additional gain by analysing the data using C-weighted levels because the statistical correlation between C-weighted and A-weighted levels was very high (i.e., $r = 0.81$–0.97) (Keith *et al.*, 2016a).

C. Data collection

1. Questionnaire content and collection

The final questionnaire, available on the Statistics Canada website (Statistics Canada, 2014) and in the supplementary materials,[1] consisted of basic socio-demographics, modules on community noise and annoyance, health effects, lifestyle behaviors and prevalent chronic illnesses. In addition to these modules, validated psychometric scales were incorporated, without modification, to assess perceived stress (Cohen *et al.*, 1983), quality of life (WHOQOL Group, 1998; Skevington *et al.*, 2004) and sleep disturbance (Buysse *et al.*, 1989).

Questionnaire data were collected through in-person home interviews by 16 Statistics Canada trained interviewers between May and September 2013. The study was introduced as the "Community Noise and Health Study" as a means of masking the true intent of the study, which was to investigate the association between health and WTN exposure. All identified dwellings within ∼600 m from a wind turbine were selected. Between 600 m and 11.22 km, dwellings were randomly selected. Once a roster of adults (between the ages of 18 and 79 years) living in the dwelling was compiled, one individual from each household was randomly invited to participate. No substitutions were permitted under any circumstances. Participants were not compensated for their participation.

2. Long-term high annoyance

To evaluate the prevalence of annoyance, participants were initially asked to spontaneously identify sources of noise they hear originating from outdoors while they are either inside or outside their home. The interviewer grouped the responses as road traffic, aircraft, railway/trains, wind turbine, and "*other*." Follow-up questions were designed to confirm the initial response where the participant may not have spontaneously identified wind turbines, rail, road and aircraft as one of the audible sources. For each audible noise source participants were asked to respond to the following question from ISO/TS (2003a): "*Thinking about the last year or so, when you are at home, how much does noise from [SOURCE] bother, disturb or annoy you?*" Response categories included the following: "*not at all*," "*slightly*," "*moderately*," "*very*," or "*extremely*." Participants who reported they did not hear a particular source of noise, were classified into a "*do not hear*" group and retained in analysis (to ensure that the correct sample size was accounted for in the modeling). The analysis of annoyance was performed after collapsing the response categories into two groups (i.e., "*highly annoyed*" and "*not highly annoyed*"). As per ISO/TS (2003a), participants reporting to be either "*very*" or "*extremely*" annoyed were treated as "*highly annoyed*" in the analysis. The "*not highly annoyed*" group was composed of participants from the remaining response categories in addition to those who did not hear wind turbines. Similarly, an analysis of the percentage highly subjectively sleep disturbed, highly noise sensitive, and highly concerned about physical safety from having wind turbines in the area was carried out applying the same classification approach used for annoyance.

The use of filter questions and an assessment of annoyance using only an adjectival scale are approaches not recommended by ISO/TS (2003a). The procedures followed in the current study were chosen to minimize the possibility of participant confusion (i.e., by asking how annoyed they are toward the noise from a source that may not be audible). Although there is value in confirming the response on the adjectival scale with a numerical scale, this approach would have added length to the questionnaire, or led to the removal of other questions. Collectively, the deviations from ISO/TS (2003a) conformed to the recommendations by Statistics Canada and to the approach adopted in a large-scale study conducted by Pedersen *et al.* (2009).

D. Statistical methodology

The analysis for categorical outcomes closely follows the description outlined in Michaud *et al.* (2013), which provides a summary of the pre-data collection study design and objectives, as well as the proposed data analysis. Final wind turbine distance and WTN categories were defined as follows: distance categories in km {≤0.550; (0.550–1]; (1–2]; (2–5]; and >5}, WTN exposure categories in dBA {<25; [25–30); [30–35); [35–40); and [40–46]}. The top category included 46 dB as only six cases were observed at ≥45 dBA. All models were adjusted for provincial differences. Province was initially assessed as an effect modifier. When the interaction between WTN and province was significant, separate models were reported for each province. This included reporting separate chi-square tests of independence or logistic regression models for each province. When the interaction was not statistically significant, province was treated as a confounder in the model. This included using the Cochran-Mantel-Haenszel (CMH) chi-square tests for contingency tables (which adjusts for confounders), as well as adjusting the logistic regression models for the confounder of province.

The questionnaire assessed participant's long-term (~1 year) annoyance to WTN in general (i.e., location not specified), and specifically with respect to location (outdoors, indoors), time of day (morning, afternoon, evening, nighttime) and season (spring, summer, fall, winter). In addition, participants' long-term annoyance in general, to road, aircraft and rail noise was assessed. These evaluations of annoyance are considered to be clustered because they are derived from the same individuals (i.e., they are repeated measures). Therefore, in order to compare the prevalence of annoyance as a function of location, time of day, season, or noise source, generalized estimating equations for repeated measures were used to account for the clustered responses (Liang and Zeger, 1986; Stokes *et al.*, 2000).

Statistical analysis was performed using SAS version 9.2 (SAS Institute Inc., 2014). A 5% statistical significance level is implemented throughout unless otherwise stated. In addition, Bonferroni corrections are made to account for all pairwise comparisons to ensure that the overall type I (false positive) error rate is less than 0.05. In cases where cell frequencies were small (i.e., <5) in the contingency tables or logistic regression models, exact tests were used as described in Agresti (2002) and Stokes *et al.* (2000).

III. RESULTS

A. Wind turbine sound pressure levels at dwellings

Modeled sound pressure levels, and the field measurements used to support the models are presented in detail by Keith *et al.* (2016a,b). Calculated outdoor sound pressure levels at the dwellings reached levels as high as 46 dB. Unless otherwise stated, all decibel references are A-weighted. Calculations are likely to yield typical worst case long-term (1 years) average WTN levels (Keith *et al.*, 2016b).

B. Response rate

Of the 2004 addresses (i.e., potential dwellings) on the sample roster, 434 dwellings were coded as out-of-scope by Statistics Canada during data collection (Table I). This was consistent with previous surveys conducted in rural areas in Canada (Statistics Canada, 2008). In the current study, 26.7% and 20.4% of addresses were deemed out-of-scope in PEI and ON, respectively. No significant difference in the distribution of out-of-scope locations by distance to the nearest wind turbine was observed in PEI ($\chi^2 = 3.19$, $p = 0.5263$). In ON, a higher proportion of out-of-scope addresses was observed in the closest distance group (≤0.55 km) compared to other distance groups ($p < 0.05$, in all cases). After adjusting for province, there was a

TABLE I. Locations coded out-of-scope.

	Distance to nearest wind turbine (km)						
	≤0.55	(0.55–1]	(1–2]	(2–5]	>5	Overall	CMH *p*-value[a]
Range of WTN (dB)	37.4–46.1	31.8–43.6	26.3–40.4	14.6–30.9	0–18.2		
Total potential dwellings	143	887	781	95	98	2004	
ON	76	718	669	60	80	1603	
PEI	67	169	112	35	18	401	
Total number of potential dwellings out-of-scope n(%)[b]	48 (33.6)	158 (17.8)	189 (24.2)	19 (20.0)	20 (20.4)	434 (21.7)	0.9755
ON	29 (38.2)	109 (15.2)	166 (24.8)	9 (15.0)	14 (17.5)	327 (20.4)	<0.0001[c]
PEI	19 (28.4)	49 (29.0)	23 (20.5)	10 (28.6)	6 (33.3)	107 (26.7)	0.5263[c]
Code A	28 (19.6)	23 (2.6)	18 (2.3)	5 (5.3)	8 (8.2)	82 (4.1)	0.0068
Code B	12 (8.4)	54 (6.1)	55 (7.0)	5 (5.3)	6 (6.1)	132 (6.6)	0.8299
Code C	2 (1.4)	36 (4.1)	61 (7.8)	7 (7.4)	1 (1.0)	107 (5.3)	
Code D	4 (2.8)	35 (3.9)	50 (6.4)	2 (2.1)	5 (5.1)	96 (4.8)	
Code E	0 (0.0)	7 (0.8)	4 (0.5)	0 (0.0)	0 (0.0)	11 (0.6)	
Code F	2(1.4)	3(0.3)	1(0.1)	0(0.0)	0(0.0)	6(0.3)	

[a]The Cochran Mantel-Haenszel chi-square test is used to adjust for province, *p*-values <0.05 are considered to be statistically significant.
[b]Total number of potential dwellings out of scope (given as a percentage of total potential dwellings) is broken down by province, as well it is equal to the sum of Code A-F. The percentages of dwellings that are coded as out-of-scope are based on the total number of potential dwellings in the area. Code A—address was a business/duplicate/other (17%), address listed in error (83%). Code B—an inhabitable dwelling unoccupied at the time of the survey, newly constructed dwelling not yet inhabited, a vacant trailer in a commercial trailer park. Code C—summer cottage, ski chalet, or hunting camps. Code D—all participants in the dwelling were >79 years of age. Code E—under construction, institution, or unavailable to participate. Code F—demolished for unknown reasons.
[c]Chi-square test of independence.

significant association between distance groups and the proportion of locations assigned a *Code A* ($p = 0.0068$) (Table I). A post-collection screening of interviewer notes by Statistics Canada has confirmed that of the total number of *Code A* locations, the vast majority (i.e., 83%) were locations listed in error. In rural areas, there is more uncertainty in developing the address list frame and this can contribute to a higher prevalence of addresses listed in error within 0.55 km of a wind turbine where the population density is lower compared to areas at greater setbacks.[2]

The remaining 1570 addresses were considered to be valid dwellings, from which 1238 residents agreed to participate in the study (606 males, 632 females). This resulted in a final response rate of 78.9%, which was not statistically different between ON and PEI or by proximity to wind turbines (Table II).

C. Sample characteristics

Table III outlines demographic information for study populations in each 5 dB WTN category. The prevalence of employment was the only variable that appeared to consistently increase within increasing WTN levels. Household income and education were unrelated to WTN levels. There was no obvious pattern to the changes observed in the other variables that were found to be statistically related to WTN level categories (i.e., age, type of dwelling, property ownership and facade type).

D. Perception of community noise and related variables as a function of WTN level

The prevalence of reporting to be very or extremely (i.e., highly) noise sensitive was statistically similar across all WTN categories ($p = 0.8175$). As expected and as shown in Fig. 1, visibility and audibility of wind turbines increased with increasing WTN levels.

The overall audibility of other noise sources is shown in Table IV. Not shown in Table IV is how often the noise source was spontaneously reported as opposed to being identified following a prompt by the interviewer (see Sec. II).

TABLE II. Sample response rate.

	Distance to nearest wind turbine (km)						
	≤0.55	(0.55–1]	(1–2]	(2–5]	>5	Overall	*p*-value
Final number of potential participants[a]	95	729	592	76	78	1570	
ON	47	609	503	51	66	1276	
PEI	48	120	89	25	12	294	
Participants n (%)	71 (74.7)	583 (80.0)	463 (78.2)	58 (76.3)	63 (80.8)	1238 (78.9)	0.9971[b]
ON	34 (72.3)	488 (80.1)	396 (78.7)	42 (82.4)	51 (77.3)	1011 (79.2)	0.7009[c]
PEI	37 (77.1)	95 (79.2)	67 (75.3)	16 (64.0)	12 (100.0)	227 (77.2)	0.1666[c]

[a]Potential participants from locations established to be valid dwellings (equal to the difference between "Total potential dwellings" and "total number of potential dwellings out-of-scope"; see Table I) used in the derivation of participation rates.
[b]The CMH chi-square test is used to adjust for province, *p*-values <0.05 are considered to be statistically significant.
[c]Chi-square test of independence.

Ex. A11-4

TABLE III. Sample characteristics.

Variable	WTN (dB) <25	[25–30)	[30–35)	[35–40)	[40–46]	Overall	CMH *p*-value[a]
n	84[b]	95[b]	304[b]	521[b]	234[b]	1238[b]	
Range of closest turbine (km)	2.32–11.22	1.29–4.47	0.73–2.69	0.44–1.56	0.25–1.05		
Range of BNTS (dB)	35–51	35–51	35–56	35–57	35–61		
BNTS (dB) mean (SD)	43.88(3.43)	44.68 (2.91)	45.21 (3.60)	43.29 (4.11)	41.43 (4.21)		
ON	44.98 (2.88)	44.86 (2.78)	45.54 (3.31)	44.06 (3.86)	42.70 (4.25)		<0.0001[c]
PEI	41.13 (3.18)	43.00 (3.67)	43.81 (4.38)	38.44 (1.59)	38.05 (1.00)		<0.0001[c]
Sex *n* (% male)	37 (44.0)	48 (50.5)	150 (49.3)	251 (48.2)	120 (51.3)	606 (49.0)	0.4554
Age mean (SE)	49.75 (1.78)	56.38 (1.37)	52.25 (0.93)	51.26 (0.68)	50.28 (1.03)	51.61 (0.44)	0.0243[d]
Marital status *n* (%)							0.2844
Married/Common-law	54 (64.3)	69 (73.4)	199 (65.7)	367 (70.6)	159 (67.9)	848 (68.7)	
Widowed/Separated/Divorced	16 (19.0)	18 (19.1)	61 (20.1)	85 (16.3)	35 (15.0)	215 (17.4)	
Single, never been married	14 (16.7)	7 (7.4)	43 (14.2)	68 (13.1)	40 (17.1)	172 (13.9)	
Employed *n* (%)	43 (51.8)	47 (49.5)	161 (53.0)	323 (62.0)	148 (63.2)	722 (58.4)	0.0012
Level of education *n* (%)							0.7221
≤High school	45 (53.6)	52 (54.7)	167 (55.1)	280 (53.7)	134 (57.3)	678 (54.8)	
Trade/Certificate/College	34 (40.5)	37 (38.9)	110 (36.3)	203 (39.0)	85 (36.3)	469 (37.9)	
University	5 (6.0)	6 (6.3)	26 (8.6)	38 (7.3)	15 (6.4)	90 (7.3)	
Income (×$1000) *n* (%)							0.8031
<60	39 (51.3)	40 (54.8)	138 (52.5)	214 (49.1)	100 (49.3)	531 (50.5)	
60-100	18 (23.7)	17 (23.3)	72 (27.4)	134 (30.7)	59 (29.1)	300 (28.5)	
≥100	19 (25.0)	16 (21.9)	53 (20.2)	88 (20.2)	44 (21.7)	220 (20.9)	
Detached dwelling *n* (%)[e]	59 (70.2)	84 (88.4)	267 (87.8)	506 (97.1)	216 (92.3)	1132 (91.4)	
ON[e]	46 (76.7)	77 (89.5)	228 (93.1)	437 (97.1)	154 (90.6)	942 (93.2)	<0.0001[f]
PEI[e]	13 (54.2)	7 (77.8)	39 (66.1)	69 (97.2)	62 (96.9)	190 (83.7)	<0.0001[f]
Property ownership *n* (%)	60 (71.4)	85 (89.5)	250 (82.2)	466 (89.4)	215 (91.9)	1076 (86.9)	
ON	45 (75.0)	78 (90.7)	215 (87.8)	399 (88.7)	157 (92.4)	894 (88.4)	0.0085[f]
PEI	15 (62.5)	7 (77.8)	35 (59.3)	67 (94.4)	58 (90.6)	182 (80.2)	<0.0001[f]
Facade type *n* (%)							0.0137
Fully bricked	20 (23.8)	30 (31.6)	85 (28.0)	138 (26.5)	67 (28.6)	340 (27.5)	
Partially bricked	24 (28.6)	29 (30.5)	62 (20.4)	88 (16.9)	15 (6.4)	218 (17.6)	
No brick/other	40 (47.6)	36 (37.9)	157 (51.6)	295 (56.6)	152 (65.0)	680 (54.9)	

[a]The Cochran Mantel-Haenszel chi-square test is used to adjust for province unless otherwise indicated, *p*-values <0.05 are considered to be statistically significant.
[b]Totals may differ due to missing data.
[c]Analysis of variance (ANOVA) model.
[d]Non-parametric two-way ANOVA model adjusted for province.
[e]Non-detached dwellings included semi/duplex/apartment.
[f]Chi-square test of independence.

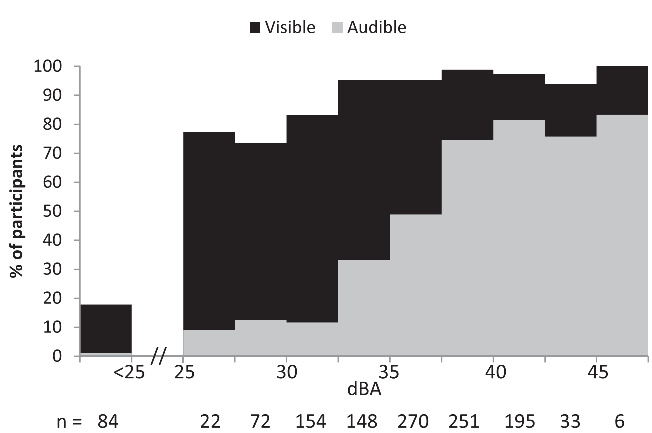

FIG. 1. Proportion of participants as a function of calculated outdoor A-weighted WTN levels. The figure plots the proportion of participants that reported wind turbines were visible from anywhere on their property or audible from inside or outside their homes from the total number of participants with valid responses living in each WTN level category.

Among the participants who reported hearing each specific noise source, the prevalence of spontaneously reporting road traffic, wind turbines, rail and aircraft was 84%, 71%, 66%, and 30%, respectively. A total of 102 participants (8.2%) indicated that there were no audible noise sources around their home. These participants lived in areas where the average WTN levels were 32.4 dB [standard deviation (SD) = 8.3] and the mean distance to the nearest turbine was 1.7 km (SD = 2.0) (data not shown).

Table IV also provides the observed prevalence rates for high (i.e., very or extreme) annoyance toward wind turbine features. The results suggest that there was a tendency for the prevalence of annoyance to increase with increasing WTN levels, with the rise in annoyance becoming evident when WTN levels exceeded 35 dB. The pattern was slightly different for visual annoyance among participants drawn from the ON sample, where there was a noticeable rise in annoyance among participants living in areas where WTN

TABLE IV. Perception of community noise and related variables.

Variable	Wind Turbine Noise (dB)					Overall	CMH *p*-value[a]
	<25	[25–30)	[30–35)	[35–40)	[40–46]		
n	84[b]	95[b]	304[b]	521[b]	234[b]	1238[b]	
Sensitivity to noise[c]	14 (16.7)	14 (14.7)	35 (11.6)	77 (14.8)	35 (15.1)	175 (14.2)	0.8175
Audible perception of transportation noise sources *n* (%)							
Road traffic	62 (73.8)	60 (63.2)	259 (85.2)	443 (85.0)	192 (82.1)	1016 (82.1)	0.0013
Aircraft	43 (51.2)	33 (34.7)	146 (48.0)	263 (50.5)	124 (53.0)	609 (49.2)	
Aircraft (ON)	32 (53.3)	31 (36.0)	120 (49.0)	220 (48.9)	82 (48.2)	485 (48.0)	0.2114[d]
Aircraft (PEI)	11 (45.8)	2 (22.2)	26 (44.1)	43 (60.6)	42 (65.6)	124 (54.6)	0.0214[d]
Rail [e]	30 (50.0)	27 (31.4)	73 (29.8)	90 (20.0)	7 (4.1)	227 (22.5)	<0.0001[d]
Perception of wind turbines *n* (%)							
See wind turbines	15 (17.9)	70 (74.5)	269 (89.1)	505 (96.9)	227 (97.0)	1086 (87.9)	<0.0001
Hear wind turbines	1 (1.2)	11 (11.6)	67 (22.0)	319 (61.2)	189 (80.8)	587 (47.4)	<0.0001
Number of years hearing the WT *n* (%)							<0.0001
Do not hear	83 (98.8)	84 (88.4)	237 (78.0)	202 (39.0)	45 (19.3)	651 (52.8)	
<1 year	1 (1.2)	2 (2.1)	15 (4.9)	31 (6.0)	12 (5.2)	61 (4.9)	
≥1 year	0 (0.0)	9 (9.5)	52 (17.1)	285 (55.0)	176 (75.5)	522 (42.3)	
Notice vibrations/rattles indoors during WTN operations	0 (0.0)	3 (3.2)	8 (2.6)	28 (5.4)	19 (8.2)	58 (4.7)	0.0004
Highly concerned about physical safety	1 (1.2)	3 (3.2)	5 (1.6)	46 (8.9)	22 (9.6)	77 (6.3)	<0.0001
Formal complaint[f]	2 (2.4)	2 (2.1)	3 (1.0)	22 (4.2)	6 (2.6)	35 (2.8)	0.2578
Reporting a high (very or extreme) level of annoyance to wind turbine features, *n* (%)							
Noise	0 (0.0)	2 (2.1)	3 (1.0)	52 (10.0)	32 (13.7)	89 (7.2)	<0.0001
Visual	2 (2.4)	15 (16.0)	17 (5.6)	81 (15.5)	44 (18.9)	159 (12.9)	
Visual (ON)	2 (3.3)	15 (17.6)	17 (7.0)	76 (16.9)	36 (21.2)	146 (14.5)	<0.0001[d]
Visual (PEI)	0 (0.0)	0 (0.0)	0 (0.0)	5 (7.0)	8 (12.7)	13 (5.8)	0.0268[d]
Blinking lights	2 (2.4)	8 (8.5)	17 (5.6)	61 (11.7)	34 (14.6)	122 (9.9)	<0.0001
Shadow flicker	0 (0.0)	3 (3.2)	6 (2.0)	51 (9.8)	36 (15.5)	96 (7.8)	<0.0001
Vibrations/rattles	0 (0.0)	1 (1.1)	2 (0.7)	9 (1.7)	7 (3.0)	19 (1.5)	0.0198
Reporting a high (very or extreme) level of WTN annoyance by time of day, *n* (%)							
Morning	0 (0.0)	0 (0.0)	1 (0.3)	28 (5.4)	10 (4.3)	39 (3.2)	
Afternoon	0 (0.0)	0 (0.0)	1 (0.3)	26 (5.0)	14 (6.1)	41 (3.3)	
Evening	0 (0.0)	1 (1.1)	2 (0.7)	48 (9.2)	26 (11.3)	77 (6.3)	
Nighttime	0 (0.0)	1 (1.1)	2 (0.7)	48 (9.2)	26 (11.3)	77 (6.3)	
Reporting a high (very or extreme) level of WTN annoyance by season, *n* (%)							
Spring	0 (0.0)	1 (1.1)	1 (0.3)	45 (8.6)	22 (9.6)	69 (5.6)	
Fall	0 (0.0)	1 (1.1)	2 (0.7)	42 (8.1)	22 (9.6)	67 (5.5)	
Summer	0 (0.0)	2 (2.1)	4 (1.3)	50 (9.6)	31 (13.7)	87 (7.1)	
Winter	0 (0.0)	1 (1.1)	1 (0.3)	38 (7.3)	21 (9.2)	61 (5.0)	
Closing bedroom window to block outside noise during sleep *n* (%)							
	26 (31.3)	30 (31.6)	87 (28.7)	178 (34.3)	68 (29.2)	389 (31.6)	0.8106
Source identified as cause for closing window[g] *n* (%)							
Road traffic	15 (18.1)	13 (13.7)	47 (15.5)	77 (14.8)	24 (10.3)	176 (14.3)	0.1161
Rail	6 (10.2)	1 (1.2)	7 (2.9)	10 (2.2)	0 (0.0)	24 (2.4)	0.0013
Wind turbines	0 (0.0)	2 (2.1)	6 (2.0)	79 (15.2)	50 (21.6)	137 (11.1)	<0.0001
Other	12 (14.5)	20 (21.1)	54 (17.8)	65 (12.5)	14 (6.0)	165 (13.4)	0.0002
Perceived benefit from having wind turbines in the area *n* (%)							
Personal	3 (3.9)	2 (2.2)	11 (4.0)	47 (9.2)	47 (20.3)	110 (9.3)	
ON	0 (0.0)	1 (1.2)	6 (2.7)	44 (10.0)	36 (21.4)	87 (9.0)	<0.0001[d]
PEI	3 (15.8)	1 (11.1)	5 (9.8)	3 (4.3)	11 (17.2)	23 (10.8)	0.1700[d]
Community	20 (29.0)	14 (20.9)	62 (36.0)	136 (35.1)	79 (40.7)	311 (35.0)	0.0135

[a]The Cochran Mantel-Haenszel chi-square test is used to adjust for provinces unless otherwise indicated, *p*-values <0.05 are considered to be statistically significant.
[b]Columns may not add to total due to missing data.
[c]Sensitivity to noise reflects the prevalence of participants that reported to be either very or extremely (i.e., highly) noise sensitive in general.
[d]Chi-square test of independence.
[e]Nobody reported hearing rail noise in PEI as there is no rail activity in PEI, therefore the percent is given as a percentage of ON participants only.
[f]Refers to anyone in the participant's household ever lodging a formal complaint (including signing a petition) regarding noise from wind turbines.
[g]Reasons for closing bedroom windows due to aircraft noise was suppressed due to low cell counts (i.e., n <5 overall).

levels were between [25 and 30) dB. The prevalence of *household* complaints concerning wind turbines, which could include signing a petition regarding noise from wind turbines, was 2.8% overall and unrelated to WTN levels ($p = 0.2578$). However, complaints were found to be greater among the PEI sample (13/224 = 5.8%), compared to ON (22/1010 = 2.2%) ($p = 0.0050$).

Other notable observations from Table IV include the finding that the number of participants who self-reported to personally benefit in any way (e.g., rent, payments or indirect benefits such as community improvements) from having turbines in their area, was not equally distributed among provinces. In ON, reporting such benefits was significantly related to WTN categories ($p < 0.0001$) and there was a gradual increase from the lowest WTN category (<25 dB: 0.0%) to the loudest WTN category ([40–46] dB: 21.4%), whereas in PEI benefits were statistically evenly distributed across the sample ($p = 0.1700$).

Closing bedroom windows to block outside noise during sleep was equally prevalent across all WTN categories ($p = 0.8106$); however, identifying WTs as the reason for closing the window was found to be related to WTN levels ($p < 0.0001$). In the two loudest categories, [35–40) dB and [40–46] dB, 15.2% and 21.6% of participants identified WTN as the reason for closing bedroom windows, respectively, compared to ≤2.1% in the other WTN categories (Table IV).

Figure 2 plots the fitted percentage highly annoyed by WTN category overall and for ON and PEI separately. WTN annoyance was observed to significantly increase when WTN levels exceeded ≥35 dB compared with lower exposure categories ($p < 0.009$, in all cases). Overall, observed prevalences of noise annoyance increased from less than 2.1% in the three lowest WTN level categories to 10% in areas where WTN levels were between [35 and 40) dB and 13.7% between [40 and 46] dB. Additionally, annoyance was observed to be significantly higher in the ON sample compared to the PEI sample. Across all WTN categories, the odds of being highly annoyed by WTN were 3.29 times greater in ON compared to PEI [95% confidence interval (CI), 1.47–8.68, $p = 0.0015$]; however, the difference was most pronounced above 35 dB.

In addition to asking participants how annoyed they were toward WTN in general (i.e., without reference to their particular location), other questions were designed to assess annoyance as a function of location (i.e., indoors, outdoors). As shown in Fig. 3, the prevalence of high annoyance was significantly higher outdoors.

The prevalence of annoyance by time of day and season is provided in Table IV. For WTN levels below 30 dB, the prevalence of high annoyance was very low (<1.2%) and similar for all times of day. Starting at 30 dB, the percentage highly annoyed during the evening and nighttime were significantly higher than the morning and afternoon; however this difference was most pronounced at WTN levels ≥35 dB. For WTN levels below 30 dB, the prevalence of high annoyance was very low (<2.2%) and similar for all seasons. At WTN levels ≥35 dB, the prevalence of high annoyance during the summer was higher compared to all other seasons.

Noise annoyance toward road, aircraft and rail noise was also assessed in the questionnaire. It was of interest to determine how annoyance to these sources compared to WTN annoyance. In areas where WTN levels were <35 dB the greatest source of noise annoyance was road traffic. In WTN categories ≥35 dB, annoyance toward WTN exceeded all other sources (p <0.0003, in all cases) (see Fig. 4).

E. Self-reported health conditions and use of medication

Table V shows that subjectively reported sleep disturbance from any source while sleeping at home over the last year, in addition to a multitude of health effects, were found

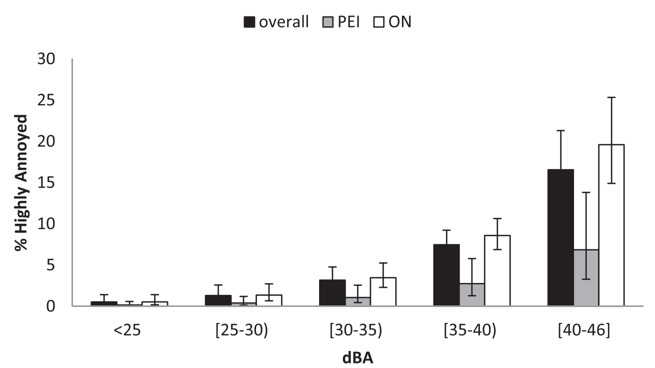

FIG. 2. Prevalence of high annoyance with wind turbine noise overall and by province as a function of calculated outdoor wind turbine noise levels. This illustrates the percentage of participants that reported to be either very or extremely (i.e., highly) bothered, disturbed or annoyed by WTN while at home over the last year. At home refers to either inside or outside the dwelling. Results are shown for participants from southwestern ON, PEI, and as an overall average. Fitted data are plotted along with their 95% confidence intervals. Results are shown as a function of calculated outdoor A-weighted WTN levels at the dwelling (dBA). WTN annoyance was observed to significantly increase when WTN levels exceeded ≥35 dB compared with lower exposure categories ($p < 0.009$, in all cases). Additionally, annoyance was observed to be significantly higher in the southwestern ON sample compared to the PEI sample ($p = 0.0015$), regardless of WTN level.

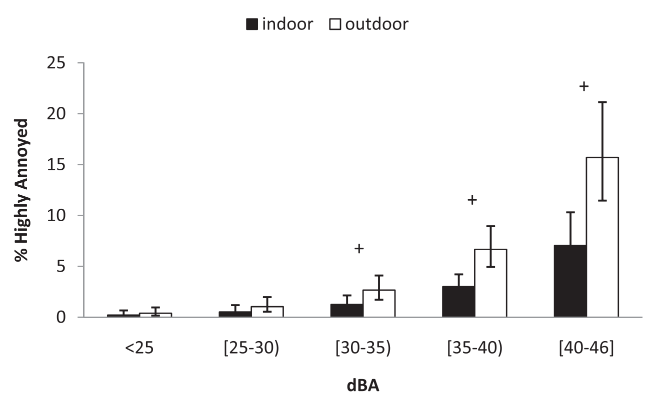

FIG. 3. Prevalence of high annoyance with wind turbine noise by location as a function of calculated outdoor wind turbine noise levels. Participants were asked to think about the last year or so and indicate how bothered, disturbed or annoyed they were by WTN while at home. The percentage of participants reporting to be either very or extremely (i.e., highly) bothered, disturbed or annoyed is shown as a function of calculated outdoor A-weighted WTN levels at the dwelling (dBA). Figure 3 presents the fitted results by location (i.e., indoors and outdoors) along with their 95% confidence intervals. + Indoor significantly different from outdoor ($p < 0.001$).

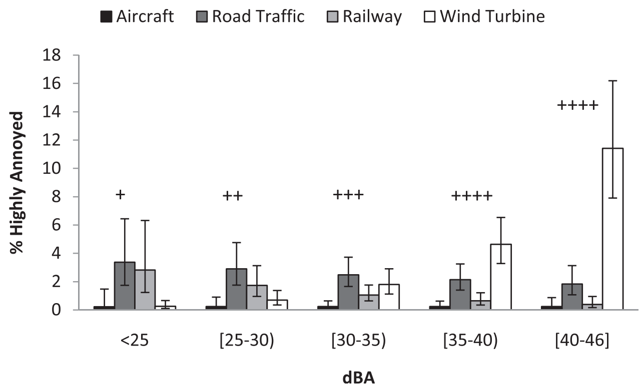

FIG. 4. Prevalence of high annoyance toward different noise sources as a function of calculated outdoor wind turbine noise levels. Illustrates the percentage of participants that reported to be either very or extremely (i.e., highly) bothered, disturbed or annoyed by road traffic, aircraft, rail and wind turbine noise (WTN) while at home over the last year. At home refers to either inside or outside the dwelling. Results represent fitted data along with their 95% confidence intervals and are shown as a function of calculated outdoor A-weighted WTN levels at the dwelling (dBA). $^{+}$WTN significantly different from road traffic and rail noise ($p < 0.001$); $^{++}$WTN significantly different from road traffic ($p < 0.001$); $^{+++}$WTN significantly different from aircraft noise ($p < 0.001$), $^{++++}$WTN significantly different from road traffic, rail, and aircraft noise ($p < 0.0003$).

to be unrelated to WTN levels. Similarly, medication use for high blood pressure, anxiety or depression was also found to be unrelated to WTN levels. Although sleep medication use was significantly related to WTN levels ($p = 0.0083$), the prevalence was *higher* among the two lowest WTN categories {<25 dB and [25–30) dB} (see Table V).

IV. DISCUSSION

The prevalence of self-reporting to be either "*very*" or "*extremely*" (i.e., highly) annoyed with several wind turbine features increased significantly with increasing A-weighted WTN levels. When classified by the prevalence of reported annoyance overall, and in areas where WTN levels exceeded 35 dB, annoyance was highest for visual aspects of wind turbines, followed by blinking lights, shadow flicker, noise and vibrations. Consistent with Pedersen *et al.* (2009), the increase in WTN annoyance was clearly evident when moving from [30–35) dB to [35–40) dB, where the prevalence of WTN annoyance increased from 1% to 10%. This continued to increase to 13.7% for areas where WTN levels were [40–46] dB. The prevalence of WTN annoyance was higher outdoors, during the summer, and during evening and nighttime hours. Pedersen *et al.* (2009) also found that annoyance with WTN was greater outdoors compared to indoors.

Despite a similar pattern of response between the ON and PEI samples, the self-reported WTN annoyance was 3.29 times greater in ON, a difference that was most pronounced at the two highest WTN categories. This difference is in contrast to the prevalence of *household* complaints related to wind turbines. Even though the overall prevalence of such complaints was low (i.e., 2.8%), complaints were more likely in PEI (5.8%) compared to ON (2.2%). The reasons for this difference despite greater reported annoyance in ON are unclear. Research has shown that there are several contingencies that must be met before someone that is highly annoyed will complain (Michaud *et al.*, 2008). Such contingencies include knowing who to complain to, how to file a complaint and holding the belief that the complaint will result in positive change. The fact that the prevalence of complaints regarding wind turbines was unrelated to WTN levels is another indication that complaints do not always correlate well with changes in noise exposure (Fidell *et al.*, 1991). The motives underlying household complaints were not assessed in the present study, but the disparity found with annoyance could also be related to the wording used in the questionnaire. The prevalence of complaints was the one question where the respondent answered on behalf of the entire household.

More participants reported that they were highly annoyed by the visual aspects of wind turbines than by any other feature, even at higher WTN levels. Similar to WTN annoyance, the overall prevalence of annoyance with the visual impact of wind turbines was more than twice as high in the ON sample, and more prevalent across the exposure categories when compared to PEI. In the PEI sample, no participants reported visual annoyance in areas where WTN levels were below 35 dB. This is in contrast to a clear intensification in visual annoyance among the ON sample in areas where WTN levels were [25–30) dB. Exploring the variables that may underscore provincial differences was not within the scope of the current study. The questionnaire was not designed to probe underlying factors that may explain observed provincial differences; however, reported personal benefit from having wind turbines in the area was found to be different between the ON and PEI samples (Table IV).

Shepherd *et al.* (2011) assessed annoyance in response to WTN, but not in a manner that would permit comparisons with the Swedish (Pedersen and Persson Waye, 2004, 2007), Dutch (Janssen *et al.*, 2011; Pedersen *et al.*, 2009) or the current study. Shepherd *et al.* (2011) reported that 59% of participants living within 2 km of a wind turbine installation spontaneously identified wind turbines as an annoying noise source, with a mean annoyance rating of 4.59 (SD, 0.65) when the 5 category adjectival scale was analyzed as a numerical scale from 0 to 5. No exposure-response relationship could be assessed because the authors did not provide an analysis based on precise distance or as a function of WTN levels, which they reported to be between 20 and 50 dB among participants living within 2 km of a wind turbine. This encompasses the entire WTN level range in the CNHS. As such, the only tentative comparison that can be made between the current study and the Shepherd *et al.* (2011) study would be that the observed prevalence of highly annoyed (i.e., "*very*" or "*extremely*") within 2 km of the nearest wind turbine was 7.0%. These data are not shown because the focus of the current study was on WTN levels and an analysis based solely on distance to the nearest turbine does not adequately account for WTN levels at any given dwelling. WTN is a more sensitive measure of exposure level because, in addition to the distance to the turbine, it accounts for topography, presence of large bodies of water, wind turbine characteristics, the layout of the wind farm and the number of wind turbines at any given distance.

Ex. A11-4

TABLE V. Sample profile of health conditions.

Variable *n* (%)	Wind turbine noise (dB) <25	[25–30)	[30–35)	[35–40)	[40–46]	Overall	CMH[a] *p*-value
n	84[b]	95[b]	304[b]	521[b]	234[b]	1238[b]	
Health worse vs last year [c]	17 (20.2)	12 (12.6)	46 (15.1)	90 (17.3)	51 (21.8)	216 (17.5)	0.1724
Migraines	18 (21.4)	24 (25.3)	56 (18.4)	134 (25.8)	57 (24.4)	289 (23.4)	0.2308
Dizziness	19 (22.6)	16 (16.8)	65 (21.4)	114 (21.9)	59 (25.2)	273 (22.1)	0.2575
Tinnitus	21 (25.0)	18 (18.9)	71 (23.4)	129 (24.8)	54 (23.2)	293 (23.7)	0.7352
Chronic pain	20 (23.8)	23 (24.2)	75 (24.8)	118 (22.6)	57 (24.5)	293 (23.7)	0.8999
Asthma	8 (9.5)	12 (12.6)	22 (7.2)	43 (8.3)	16 (6.8)	101 (8.2)	0.2436
Arthritis	23 (27.4)	38 (40.0)	98 (32.2)	175 (33.7)	68 (29.1)	402 (32.5)	0.6397
High blood pressure (BP)	24 (28.6)	36 (37.9)	81 (26.8)	166 (32.0)	65 (27.8)	372 (30.2)	0.7385
Medication for high BP	26 (31.3)	34 (35.8)	84 (27.6)	163 (31.3)	63 (27.0)	370 (29.9)	0.4250
Family history of high BP	44 (52.4)	49 (53.8)	132 (45.5)	254 (50.6)	121 (53.8)	600 (50.3)	0.6015
Chronic bronchitis/emphysema/COPD	3 (3.6)	10 (10.8)	17 (5.6)	27 (5.2)	14 (6.0)	71 (5.7)	0.7676
Diabetes	7 (8.3)	8 (8.4)	33 (10.9)	46 (8.8)	19 (8.2)	113 (9.1)	0.6890
Heart disease	8 (9.5)	7 (7.4)	31 (10.2)	32 (6.1)	17 (7.3)	95 (7.7)	0.2110
Highly sleep disturbed[d]	13 (15.7)	11 (11.6)	41 (13.5)	75 (14.5)	24 (10.3)	164 (13.3)	0.4300
Diagnosed sleep disorder	13 (15.5)	10 (10.5)	27 (8.9)	44 (8.4)	25 (10.7)	119 (9.6)	0.3102
Sleep medication	16 (19.0)	18 (18.9)	39 (12.8)	46 (8.8)	29 (12.4)	148 (12.0)	0.0083
Restless leg syndrome	7 (8.3)	16 (16.8)	37 (12.2)	81 (15.5)	33 (14.1)	174 (14.1)	
Restless leg syndrome (ON)	4 (6.7)	15 (17.4)	27 (11.0)	78 (17.3)	28 (16.5)	152 (15.0)	0.0629[e]
Restless leg syndrome (PEI)	3 (12.5)	1 (11.1)	10 (16.9)	3 (4.2)	5 (7.8)	22 (9.7)	0.1628[e]
Medication anxiety or depression	11 (13.1)	14 (14.7)	35 (11.5)	59 (11.3)	23 (9.8)	142 (11.5)	0.2470
QoL past month[f]							
Poor	9 (10.8)	3 (3.2)	21 (6.9)	29 (5.6)	20 (8.6)	82 (6.6)	0.9814
Good	74 (89.2)	92 (96.8)	283 (93.1)	492 (94.4)	213 (91.4)	1154 (93.4)	
Satisfaction with health[f]							
Dissatisfied	13 (15.5)	13 (13.7)	49 (16.1)	66 (12.7)	36 (15.4)	177 (14.3)	0.7262
Satisfied	71 (84.5)	82 (86.3)	255 (83.9)	455 (87.3)	198 (84.6)	1061 (85.7)	

[a]The Cochran Mantel-Haenszel chi-square test is used to adjust for provinces unless otherwise indicated, *p*-values <0.05 are considered to be statistically significant.
[b]Columns may not add to total due to missing data.
[c]Worse consists of the two ratings: "*Somewhat worse now*" and "*Much worse now*."
[d]High sleep disturbance consists of the two ratings: "*very*" and "*extremely*" sleep disturbed.
[e]Chi-square test of independence.
[f]Quality of Life (QoL) and Satisfaction with Health were assessed with the two stand-alone questions on the WHOQOL-BREF. Reporting "*poor*" overall QoL reflects a response of "*poor*" or "*very poor*," and "*good*" reflects a response of "*neither poor nor good*," "*good*," or "*very good*." Reporting "*dissatisfied*" overall Satisfaction with Health reflects a response of "*very dissatisfied*" or "*dissatisfied*," and "*satisfied*" reflects a response of "*neither satisfied nor dissatisfied*," "*satisfied*," or "*very satisfied*." A detailed presentation of the results related to QoL is presented by Feder *et al*. (2015).

It was important to assess the extent to which the sample was homogenously distributed, with respect to demographics and community noise exposure. The reason for this is that the validity of the exposure-response relationship is strengthened when the primary distinction across the sample is the exposure of interest; in this case, WTN levels. Demographically, some minor differences were found with respect to age, employment, type of dwelling and dwelling ownership; however, with the possible exception of employment, these factors showed no obvious pattern with WTN levels and none were strong enough to exert an influence on the overall results. At the design stage, there was some concern that selecting participants up to 10 km might result in an unequal exposure to community noise sources other than WTN. This may have an influence on the underlying response to WTN. Limited data availability did not permit the modeling of sound pressure levels from other noise sources as originally intended, however it was possible to model BNTS levels. Although Fields (1993) concluded that background sound levels generally do not influence community annoyance, his review did not include wind turbines as a noise source and in the current study BNTS levels were calculated to be lower in areas where WTN levels were higher. Lower BNTS could contribute to a greater expectation of peace and quiet. Therefore, a limitation in the CNHS may be that the expectation of peace and quiet was not explicitly evaluated. This factor may influence the association between long-term sound levels and annoyance by an equivalent of up to 10 dB (ANSI, 1996; ISO, 2003b). The influence this factor may have had on the exposure-response relationship found specifically between WTN levels and the prevalence of reporting high annoyance with WTN in the CHNS is discussed in Michaud *et al*. (2016a).

In the absence of modeling, the audibility of road traffic, aircraft and rail noise provided a crude indication of exposure to these sources. In general, road traffic noise exposure was heard by the vast majority of the sample (82.1%).

Aircraft noise was uniformly audible in ON by about half the sample; in PEI however, hearing aircraft was more common in the higher WTN exposure categories (i.e., above 35 dB) where between 61% and 66% of the respondents indicated that they could hear aircraft. Future research may benefit from assessing the extent to which audible aircraft noise may have influenced the annoyance with WTN in PEI. Only when WTN levels were [40–46] dB was the audibility of wind turbines comparable to road traffic (i.e., both sources were audible by approximately 81% of participants). For these community noise sources, participants were asked how bothered, disturbed, or annoyed they were while at home over the last year or so. The findings are of interest in light of the source comparisons made by Pedersen *et al.* (2009) and Janssen *et al.* (2011), which placed WTN annoyance above all transportation noise sources when comparing them at equal sound levels. In the current study, the overall annoyance toward WTN (7.2%) was found to be higher in comparison to road (3.8%), aircraft (0.4%), and rail in ON (1.9%). Source comparisons need to be made with caution because the observed source differences in annoyance may result from an *actual* difference in sound pressure levels at the dwellings in this study. Modeling the sound levels from transportation noise sources in the current study would allow a more direct comparison between these sources and WTN annoyance at equivalent sound exposures. Another approach is to assess the relative community tolerance level of WTN with that reported for road and aircraft noise studies. This analysis indicates that there is a lower community tolerance level for WTN when compared to both road and aircraft noise at equivalent sound levels (Michaud *et al.*, 2016a).

The list of symptoms that are claimed to be caused by exposure to WTN is considerable (Chapman, 2013), but there is a lack of robust evidence from epidemiological studies to support these associations (Council of Canadian Academies, 2015; Knopper *et al.*, 2014; MassDEP MDPH, 2012; McCunney *et al.*, 2014; Merlin *et al.*, 2014). The results from the current study did not show any statistically significant increase in the self-reported prevalence of chronic pain, asthma, arthritis, high blood pressure, bronchitis, emphysema, chronic obstructive pulmonary disease (COPD), diabetes, heart disease, migraines/headaches, dizziness, or tinnitus in relation to WTN exposure up to 46 dB. In other words, individuals with these conditions were equally distributed among WTN exposure categories. Similarly, the prevalence of reporting to be highly sleep disturbed (for any reason) and being diagnosed with a sleep disorder were unrelated to WTN exposure. These self-reported findings are consistent with the conclusions reached following an analysis of objectively measured sleep among a subsample of the current study participants (Michaud *et al.*, 2016b). Medication use (for anxiety, depression, or high blood pressure) was unrelated to WTN levels. It is notable that the observed prevalence for many of the aforementioned health effects are remarkably consistent with large-scale national population-based studies (Innes *et al.*, 2011; Kroenke and Price, 1993; Morin *et al.*, 2011; O'Brien *et al.*, 1994; Shargorodsky *et al.*, 2010).

V. CONCLUDING REMARKS

Study findings indicate that annoyance toward all features related to wind turbines, including noise, vibrations, shadow flicker, aircraft warning lights and the visual impact, increased as WTN levels increased. The observed increase in annoyance tended to occur when WTN levels exceeded 35 dB and were undiminished between 40 and 46 dB. Beyond annoyance, the current study does not support an association between exposures to WTN up to 46 dB and the evaluated health-related endpoints. In some cases, there were clear differences between the southwestern ON and PEI participants; however, exploring the basis behind these differences fell outside the study scope and objectives. The CNHS supported the development of a model for community annoyance toward WTN, which identifies some of the factors that may influence this response (Michaud *et al.*, 2016a). At the very least, the observed differences reported between ON and PEI in the current study demonstrates that even at comparable WTN levels, the community response to wind turbines is not necessarily uniform across Canada. Future studies designed to intentionally explore the factors that underscore such differences may be beneficial.

ACKNOWLEDGMENTS

The authors acknowledge the support they received throughout the study from Serge Legault and Suki Abeysekera at Statistics Canada, and are especially grateful to the volunteers who participated in this study. The authors have declared that no competing interests exist.

[1]See supplementary material at http://dx.doi.org/10.1121/1.4942391 for the univariate analysis results.

[2]Locations coded as out-of-scope were originally assigned the following categories: *Demolished for unknown reasons*, *vacant for unknown reasons*, *unoccupied*, *seasonal*, *>79 years of age*, and *other* (Michaud, 2015b; Health Canada, 2014). In an effort to address feedback and provide further clarification, the categories used to define out-of-scope locations were further defined elsewhere (Michaud, 2015a) with additional details provided in the current paper. Specifically, locations that were determined to be "demolished for unknown reasons" are presented separately in Table I as Code F. Locations that were originally defined as "unoccupied for unknown reasons" are now more precisely defined under Code B (i.e., inhabitable dwelling not occupied at time of survey, newly constructed dwelling, or unoccupied trailer in vacant trailer park). Furthermore, it was confirmed that 6 dwellings originally listed under Code B (Michaud, 2015a) were in fact GPS coordinates listed in error and have therefore been reassigned to Code A.

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