

Grounded Theory as an Analytical Tool to Explore Housing Decisions Related to Living in the Vicinity of Industrial Wind Turbines

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Abstract

Background: Some people living near wind turbines have reported adverse health effects and taken the step to vacate/abandon their homes, while others contemplate doing so or have decided to remain in their homes. Research on the extent and outcomes of these events is lacking. To date, our preliminary findings and an overview of results have been published in the scientific literature. **Methods:** This study utilized a qualitative methodology, specifically Grounded Theory, to interview 67 residents of Ontario living within 10 km of an industrial wind turbine project. **Objectives:** Quantitative, qualitative and mixed methods research each has strengths and weaknesses in addressing particular research questions. The purpose of this article is to compare the qualitative and quantitative methodologies and to describe the benefits of having used a qualitative methodology, specifically Grounded Theory, to explore the events that influenced families living within 10 km of wind energy facilities to contemplate vacating their homes and to formulate a substantive theory regarding these housing decisions. **Results:** It was found that research

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into the impacts of siting industrial wind turbines in a rural residential population can be challenging for a quantitative methodological approach due to factors such as low population density, obtaining a sufficient sample, and achieving statistical power and statistical significance. We conclude that the Grounded Theory methodology was applicable to this study as it assisted with the development of a coherent theory which explained participants' housing decisions. **Discussion:** This paper assesses the appropriateness of a qualitative methodology for conducting the vacated/abandoned home study. Through the utilization of the qualitative Grounded Theory methodology, government authorities, researchers, medical and health practitioners, social scientists and policy makers with an interest in health policy and disease prevention have the opportunity to gain an awareness of the potential risk of placing wind energy projects near family homes.

Subject Areas

Civil Engineering

Keywords

Wind Turbines, Vacated/Abandoned Homes, Qualitative Research, Grounded Theory

1. Background

The purpose of the vacated/abandoned home study is to explore why some families living within 10 km of a wind energy facility contemplate vacating their homes. This ethics approved study employed a qualitative method, specifically the Grounded Theory (GT) proposed by Castillo-Montoya, 2016 [1]. Study participants were given an opportunity to describe the events that led to their housing decisions through in-depth, semi-structured interviews.

To date, two previously published articles are available that provide details about the purpose of this study, its methodology, research questions, results and examples of the research participants' descriptions related to their housing decisions. The findings of these published articles are based on the data analysis that was conducted [2] [3].

The purpose of this third article is to explore the differences between the quantitative and qualitative methodologies and the basis for selecting the Grounded Theory qualitative approach for the vacated/abandoned home study. In exploring the siting of wind energy facilities in rural communities, we identify some of the research challenges associated with the vacated/abandoned homes topic such as the variety of zoning bylaws, rural population density and sampling challenges, and the ability to achieve statistical power and statistical significance.

Between October 2017 and January 2018, 67 consenting participants were interviewed. Due to the extent of our findings, additional manuscripts will be submitted to scientific journals for peer-review.

While the risks of harm to humans associated with exposure to wind energy facilities have been controversial and debated globally, [4]-[10] in Ontario and internationally, there are reports of families who have taken the step to vacate/ abandon their homes associated with living near industrial wind turbines (IWTs). These reports are available through sources such as judicial proceedings (testimony, factums, written submissions and legal arguments), government hearings, the scientific literature, social media, and Internet websites [5] [9]-[20]. Despite such reports, research on the rationale, extent and outcomes related to vacating/abandoning a home are limited.

Typically, housing decisions are based on a change in circumstances such as: seeking a less expensive or better home, retirement, a job opportunity, a change in marital status, down-sizing, and access to health care [3]. However, this study found that a systematic methodology—the Grounded Theory approach—served as a practical tool to lend support to the theory that:

housing decisions were motivated by the proximity of wind energy facilities within 10 km of homes and the participants' observations of the occurrence or potential risk of adverse health effects [3].

2. Industrial Wind Turbines in Rural Communities

Several factors can affect the approval process of a wind energy facility. They include the variety of federal, state/provincial and local laws such as zoning rules, bylaws and requirements for various studies for noise, setbacks, natural species and the environment. Other factors can include consideration of IWT research findings by the authorities involved with the approval process and whether there is sufficient land available for developing, installing and operating the facility.

In contrast to small-scale units for residential use, the siting of IWTs requires a large amount of land. While some urban development may include an industrial park that is zoned for "industrial use rather than residential or commercial needs" [21], IWTs "function better" when placed in a rural location [22]. Brenner (2018) comments:

Wind farms don't work in crowded residential areas where the noise pollution bothers humans. They also don't work where birds frequent because the turbines can kill these flying animals when they unknowingly fly into them. Wind turbines and farms perform better in unpopulated windy areas with access to the power grid [23].

In Ontario, IWTs are mostly installed in a regular grid pattern in rural areas [24] and are usually sited on private lands, zoned agricultural, with a minority on Crown land [25] and First Nations reserve lands [26]. The total area (foot-print) of a wind energy project has been defined as the "area within a perimeter surrounding all of the turbines within that project" [27]. In 2012, a project comprised of 140 turbine generators was approved by the Ontario Ministry of Environment [28]. Based on the Project Description Report of November 12, 2012,

the project covers approximately 190 square km (about 46,950 acres) [29]. It was reported that about 5000 people residing within 5 km of the project's wind turbines were eligible to participate in a study being conducted by the local Medical Officer of Health [30]. *For details: see* 4.0 *Quantitative research: determining statistical power and statistical significance.*

As part of Ontario's approval process, nearby points of noise reception or "receptors" defined as point(s) where noise is measured or estimated are typically identified in a noise report [31]. Receptors may include residences, vacant lots, or public buildings such as schools. For example, a consultant who conducted a noise study for another Ontario-based project identified 2336 receptors (homes, businesses, public building and lots) as being the "most sensitive" points of reception. Some receptors were within 2 km of the proposed turbines or transformers. For those within 1.5 km, noise estimates were conducted by noise modelling. Three of the 83 Participating Receptors (those who have signed a lease to host one or more turbines on their land) agreed that the sound limit levels of 40 dBA can be exceeded: therefore, the sound level limits of the report do not apply to the three Participating Receptors [32].

Figure 1 provides a 2011 image based on the number of Ontario wind energy projects being proposed in a predominantly rural area. The yellow-colored dots that represent the wind turbines indicate their approximate location within the project areas and provide a sense of their density [33]. A review of government records indicates most of these proposed projects are now operational [4].



Figure 1. An image based on the number of wind energy projects being proposed in a predominantly rural area (2011) [33].

Given that Regulation 359/09 of Ontario's Environmental Protection Act requires a minimum setback of 550 m from the center of a turbine base to a noise receptor such as a dwelling [34], urban settings could not readily accommodate such facilities. Depending on a facility's operational status, those residing within a project's perimeter could potentially be at risk of exposure to noise and other factors for extended periods of time.

By 2019, 94 projects were operating a total of 2681 wind turbines in rural Ontario [35].

3. How Qualitative and Quantitative Methodologies Differ

Research has been described as a "systematic, rigorous investigation of a situation or problem in order to generate new knowledge or validate existing knowledge" [36]. Health care research includes both quantitative and qualitative methodologies, the latter of which encompasses the Grounded Theory [36].

Qualitative and quantitative methodologies can be used to collect and analyse data and to answer different kinds of research questions [37]. While qualitative research is time-consuming, it provides ability to "probe for underlying values, beliefs, and assumptions" [38]. The quantitative and qualitative methods have been combined to aid in the generalizability of qualitative findings ([39] p. 94). In Ontario, both qualitative and quantitative research methodologies are discussed in the government's educational curriculum for grades 9 through 12 [40].

Research associated with adverse health effects and IWTs typically has been conducted using a quantitative methodology [41] [42] [43] [44]. Quantitative research relies on statistical and numerical/mathematical methods while qualitative research considers non-numerical data, narratives, observations, and social issues. By using uninterrupted narratives, the qualitative method tends to collect rich and lengthy data from a small group of respondents: it does not analyse data using statistical methods but rather considers thematic context [37] [39] [45] [46]. Within sociology, a qualitative method typically focuses on the "micro-level of social interaction that composes everyday life, whereas quantitative research typically focuses on macro-level trends and phenomena" [45].

The qualitative method aims to:

answer questions about the "**what**", "**how**" or "**why**" of a phenomenon rather than "**how many**" or "**how much**", which are answered by quantitative methods [46] (*Emphasis by authors Bricki & Green*).

During qualitative research, words are used to understand concepts, thoughts or experiences and facilitate the gathering of "in-depth insights" on topics that "are not well understood." Quantitative research is expressed in "numbers and statistics," is used to test or confirm "theories and assumptions," and can be used to establish "generalizable facts" regarding a topic [37].

Benefits of qualitative research include flexibility and ease of adapting to

changes in the research environment and an ability to conduct research with minimal cost [45]. While downsides to qualitative research include a limited scope and findings that may not be readily generalized [45], at the same time:

Rather than aiming for statistical or empirical generalization, qualitative research often seeks to produce concepts which are theoretically generalizable [39].

Bloor and Wood (2006) define Grounded Theory as an approach that moves from "specific instances" to "general conclusions" [39].

Grounded theory is commonly written about as if it were a *technique* of analysis, but it is probably more accurately described as an *approach* to analysis which may use a bundle of specific techniques in flexible and different ways, with the aim of generating theoretical insights from qualitative data. The important point is that the theory comes from the data: the approach is therefore *inductive*, rather than *deductive* – moving from specific instances to general conclusions [39] (*Emphasis by authors Bloor and Wood*).

Grounded Theory has been applied to a number of different disciplines such as health research, law, economics and business studies [47] and to research "social justice" and conduct "critical inquiry in the public sphere" [48]. A characteristic of Grounded Theory is its sampling approach (theoretical sampling), which is directed at supporting "theory development" and adjusted in response to "emerging theory" [49].

Grounded Theory establishes an inquiry-based conversation and supports the aim to "garner rich and productive data to answer pressing research questions across a variety of fields" [1].

Qualitative research including Grounded Theory, can include the use of narrative/in-depth interviews, [1] [46] [48] [49] observational techniques, [1] [46] [50] [51] [52] and a frequency distribution of words [53] [54] to construct a "word cloud", *i.e.*, a graphical representation that can be analysed [54] [55].

Figure 2 provides a visual overview of the differences between the qualitative and quantitative methodologies.

4. Quantitative Research: Determining Statistical Power and Statistical Significance

To determine statistical power, the effect on a population, the ability to detect it, and the probability of rejecting the null hypothesis need to be considered. [56] Statistical relationships could occur either by chance and can be affected by the study sample's size [57]. While a standard research question asks what sample size will give a reasonable statistical power for the "primary hypothesis" being investigated, in many cases, a "more realistic" question would be:

what will the statistical power be for the important hypothesis tests, given the most likely sample size that can be obtained during the duration of the proposed study? [58]

Quantitative Research	Qualitative Research
Focuses on testing theories and hypotheses	Focuses on exploring ideas and formulating a theory or hypothesis
Analyzed through math and statistical analysis	Analyzed by summarizing, categorizing and interpreting
Mainly expressed in numbers, graphs and tables	Mainly expressed in words
Requires many respondents	Requires few respondents
Closed (multiple choice) questions	Open-ended questions
Key terms: testing, measurement, objectivity, replicability	Key terms: understanding, context, complexity, subjectivity

Figure 2. Quantitative verses Qualitative research methods. Reproduced with kind permission: Raimo Streefkerk, April 12, 2019. Qualitative vs. quantitative research. Scribbr. [37] https://www.scribbr.com/methodology/qualitative-quantitative-research/.

Tenny and Abdelgawad (2019) comment that quantitative research has "issues of concern" including choosing the alpha (significance level), and the statistical analysis method and clinical significance. The alpha (p-value) refers to a pre-chosen probability of being wrong due to chance. Selecting the correct statistical analytical method to obtain a p-value depends on the "type of data, number of data points, and the question being asked". If the wrong method is chosen the result "may be meaningless as an incorrect p-value would be calculated" [59].

When researching outcomes of living near IWTs, it can be challenging to achieve statistical power and statistical significance using a quantitative methodology. For example, during the Health Canada Wind Turbine Noise and Health epidemiological study, the final sample size consisted of 2004 potential households. Of these 2004 households, 434 were coded as out-of-scope, resulting in 1570 being considered as valid dwellings. Of these 1570 households, a total of 1238 households with similar demographics participated [60]. Correspondence from a Health Canada representative acknowledged that the study design did not have the necessary "statistical power to conduct an analysis of individual wind facilities (e.g. annoyance in site A vs site B)" [61]. Health Canada has cautioned that regarding the Health Canada Study design:

results will not provide a definitive answer on their own [62].

results may not be generalized to areas beyond the sample as the wind turbine locations in this study were not randomly selected from all possible sites operating in Canada.

results do not permit any conclusions about causality.

results should be considered in the context of all published peer-reviewed literature on the subject [60].

Regarding a quantitative methodology, other research challenges could be related to recruitment in a rural population and/or the chosen parameters when applying a study design.

Since quantitative research typically requires a larger "sample size" than a qualitative methodology [63], recruiting a sufficient number of participants from a rural population can be challenging. For example, studies were conducted between 2010 and 2015 by the Ontario Research Chair in Renewable Energy Technologies and Health, a group funded in 2010 by the Ontario Ministry of Environment [64]. During the Chair's 5-year study, the Ontario government approved numerous wind turbine projects that initiated operations [4]. The Research Chair's recruitment approach considered the benefits and shortcomings of distributing 4876 surveys by Canada Post unaddressed Admail in rural community mailboxes to people living within 5 km of a wind turbine. The overall response was 8.1% (395 participants). The authors commented that this response rate could likely have been the "result of the specific research topic" [65].

Another study was initiated by the area's local Ontario Medical Officer of Health as the result of complaints filed by rural residents who were living near the wind turbines [66]. All of the approximately 30,000 residents living within 10 km of a wind turbine were invited to participate. It was reported that 5000 letters were mailed to residents [30] within or mostly within 5 km of a wind turbine [66]. However, in some cases, the area and postal route may not have aligned so some residents may not have received a letter [66]. In order to conduct the planned study analysis, at least 1000 participants were required [67]. However, including 5 residents under 16 years old, only 109 residents participated, *i.e.*, less than 1% of the eligible population [67]. A communiqué from the Medical Officer of Health, while sympathetic to the ongoing concerns said that the study analysis would not provide enough information to be able to state "whether or not the presence of wind turbines have an adverse effect on the PUBLIC health" and suggested that individuals seek resolution through the courts [68] (emphasis of "PUBLIC" by the Medical Officer of Health). It was reported that reasons given for not participating included that due to the lack of the health unit's regulatory authority to shut down the turbines, there was no point to participate in the study, frustration with the delay in starting the study, and not wanting to deal with the wind turbines "any more" [30]. While findings could not be applied to other residents due to selection bias, the final report stated:

Analysis of study participants confirmed an association between wind turbine exposure and annoyance. Of participating households within one kilometre of at least one wind turbine, 58% had at least one person reporting they were bothered, disturbed or annoyed by noise or light from wind turbines [67].

Study results could potentially be affected by the parameters chosen for the study design. For example, during the Health Canada Wind Turbine Noise and

Health study, those between the ages of 18 and 79 years were randomly selected [60] resulting in the vulnerable (children and those over age 79) who were living near the IWTs being unable to participate. While individuals were randomly selected, wind turbine sites were not [69].

Another chosen parameter was the use of calculated wind turbine noise (WTN) levels (dBA). Health Canada commented that these were "likely to be representative of yearly averages with an uncertainty of about ±5 dB and therefore can be compared to World Health Organization (WHO) guidelines" [60]. Regarding other noise characteristics, Health Canada acknowledged that the long-term wind turbine calculations did not investigate "specific noise characteristics, such as amplitude modulation and/or the presence of tones," were insensitive to "to very brief changes" in wind turbine noise levels and the findings were "representative only of areas where long-term outdoor WTN levels do not exceed 46 dBA (or 63 dBC)" [69].

The Administrative Appeals Tribunal (AAT), appointed by the Attorney General of Australia, provides an independent review of decisions made by the Australian Government. Following testimony related to the Health Canada study, the Tribunal stated in its Decision that:

A major limitation is that the conclusions of the study were based on calculated, rather than actual, noise measurements (although some of the calculated noise levels were based on measurements). However, as we understand the evidence, the sound generated by wind turbines is so variable that actual measurements are to be preferred.

All of the evidence before us is to the effect that WTN cannot be accurately captured in dB(A), or even dB(C) (although dB(C) is preferable) [70] [pg 146] [para. 478 & 479].

It appears that during the interviews conducted by Health Canada representatives and the taking of the objective measurements of heart rate and blood pressure, it was unknown whether the wind turbines were turned off or on, operating at partial or full capacity, or ramping up or down [71]. It is suggested that future research could benefit by having access to the SCADA (Supervisory Control and Data Acquisition) system in order to determine the operational status of the wind turbines during objective and subjective measurements.

Health Canada publicly advised that the raw data originating from its study were available to Canadians, other jurisdictions and interested parties through the Health Canada website, open access journals and conference presentations, and the Federal Resource Data Center (RDC). Regarding the RDC process, there has been a lack of ability to obtain the "complete file of un-interpreted, *i.e.*, raw data" [71].

While the Health Canada study results have been cited during judicial proceedings [70] [72] [73], it would be advantageous that decision-making authorities be made aware of, and understand the research challenges and limitations associated with this topic. It is proposed that research related to housing decisions of residents contemplating to vacate/abandon their homes when living near IWTs would benefit from a qualitative methodology.

5. The Qualitative Methodology: Grounding the Vacated/Abandoned Homes Research

The methodology of the vacated/abandoned home study has been provided in two published articles [2] [3]. The intention of this section is to describe the benefits of having used a qualitative/Grounded Theory methodology.

Grounded Theory is designed to discover:

what problems exist in a given social environment and how the persons involved handle them; it involves formulation, testing, and reformulation of propositions until a theory is developed [36].

It is recommended that use of the Grounded Theory methodology be preceded by a pilot study so the parameters and analytic methods can be firmly established. With completion of the study design and ethics approval, a pilot was conducted in a neutral manner using the concepts described for this method. During the pilot, an inquiry-based conversation was established by the interviewer. Demographic information was collected and a brief topic guide was utilized. The semi-structured interview was initiated by asking a non-threatening introductory question (different than the research questions) that was followed with transition questions as needed to seek further clarification. At the interview's conclusion, participants were given an opportunity to raise any additional issues.

The outcome of the pilot was consistent with a qualitative research method that takes a more informal conversational approach. The results from the pilot indicated the information that could be collected on the vacated/abandoned home topic was substantial. The pilot also revealed that while the interview questions were distinct from the research questions, they were found to be aligned. Based on the feedback received from the pilot, it was found that the application of the Grounded Theory approach would give informative/meaningful results in the vacated/abandoned home study.

Due to the subject matter, every effort was made to design a study that considered the topic being researched and to accurately represent the voices of participants. For the comfort of those being interviewed, face-to-face interviews were conducted in the participants' homes whenever possible. In a few cases, due to weather conditions and travel distances, interviews were conducted by telephone. While participants were advised the interview could take up to an hour, there were no time limits placed on those being interviewed.

Interviews were shaped partly by a topic guide provided to the interviewers and partly by concerns raised by participants [39]. These interviews dealt with "phenomena that are difficult or impossible to quantify mathematically, such as beliefs, meanings, attributes, and symbols" [36] and assisted with the investigation of this topic—the "meanings people attribute to their behavior, actions, and interactions with others" [45].

Other Grounded Theory processes were utilized such as systematically building theory through an iterative process until theoretical saturation (no new information) was obtained [2]. Sampling was "purposeful" and focused on groups and individuals likely to generate useful data and utilized key informants such as community leaders [46].

Descriptive data were interpreted using rigorous and systematic methods of transcribing, coding, and analysing trends and themes [45]. Audio files transcribed to text supported the iterative process and the data using the NVivo Pro software (v.12.6) to code and analyse the participants' observations and categorize themes and sub-themes [2] [3]. See Figure 3: Themes and sub-themes and their relationship to the 5 Elements.



Figure 3. Themes and sub-themes and their relationship to the 5 Elements. * Originally published in the Open Access Library Journal: Krogh, C.M., McMurtry, R.Y., Johnson, B.W., Dumbrille, A., Alves-Pereira, M.L., Punch, J.L., Hughes, D., Rogers, L., Rand, R.W., James, R., Ambrose, S.E., and Gillis, L. Wind Turbines: Why Some Families Living in Proximity to Wind Energy Facilities Contemplate Vacating Their Homes: An Overview of Findings. Open Access Library Journal Vol.7 No.6, June 28, 2020 https://doi.org/10.4236/oalib.1106443.

As new data were introduced, the themes and sub-themes evolved. Data were continually interpreted. Software facilitated the coding/indexing of data according to different analytical categories and supported the ability to constantly compare the codes to the themes. This contributed towards achieving consistency and reliability and to storing and systematically retrieving the acquired data [39]. Data analysis began with the first interview and continued sequentially until the 67th interview when theoretical saturation was reached [3] and each category saturated [49] [75], *i.e.*, "no new insights or new dimensions" to categories were identified. [49] The codes, categories, and themes were drawn from the data [74] [75]. This contributed towards generating a hypothesis and exploration and understanding of the area under study [74] and the reasons for the data [76].

Since prior knowledge about the vacated homes topic is "limited" [75] the Grounded Theory inductive methodology was appropriate. The study data indicate that this topic is complex and multi-faceted [49]. The Grounded Theory approach contributed towards gaining an "understanding of participants' experiences, how they describe those experiences and the meaning they make of those experiences" [1]. Additional benefits of the Grounded Theory methodology included the opportunity to "capture context and complexity in social action" and investigate an emerging topic [49]. Focusing on everyday life and people's experiences contributed towards a new theory that can be tested to confirm the results [45]. As the interviews progressed, the candid and insightful observations of research participants continually added to the findings. Combined, the qualitative and Grounded Theory methodologies and iterative process contributed towards an in-depth understanding of the impact of making housing decisions under difficult circumstances.

Maintaining the iterative process was facilitated by including functional requirements such as process control, scrutinizer capability and logistical control and coordination in the study design. These processes and the capability to simultaneously recruit participants, conduct interviews and manage participant selection were supported by the logistical coordination managed by the study's process controller.

While the interpretation and analysis of the data were conducted by the Principal Investigator, four colleagues independently reviewed and confirmed the data analysis and related themes and sub-themes in order to address potential subjectivity. This independent review contributed towards this study's internal validity of the findings. In this context, validity is the extent to which the research produces an accurate version of the world of participants [39]. Study participants, many of whom did not know each other, were located throughout the province of Ontario and lived among a number of different wind energy projects. Participants included those living near facilities that had been operating for several years, had recently initiated operations, or were not yet operating. Based on the interviews and data analyses, there was a consistency in the participants' descriptions of events and resulting themes and sub-themes. The opportunity to consider a cross section of participants and wind energy projects contributed towards answering the research questions and lent support to the outcomes associated with living within 10 km of wind turbine projects.

Some of the vacated/abandoned home study results are similar to several studies that utilized the Grounded Theory methodology [77] [78].

In 2007, a study was conducted to gain a "deeper understanding of how people perceive and are affected by wind turbines in their living environment." The authors commented that the Grounded Theory methodology was useful "when a new perspective of a research area is needed, as in the studies of wind turbines' impact on people living close by." Some of those interviewed moved to other rooms or places to "escape disturbance" and some described "feelings of being subjected to injustice" and having negative feelings towards the wind turbines. Sentiments of a social "price", including loss of "good, neighborly relations" were also described [77]. The authors concluded:

This study revealed some important factors than can explain the feelings and reactions observed among people living in the vicinity of wind turbines. Some of the informants appraised the wind turbines as intruders, a finding that to our knowledge has not been reported elsewhere.

Negative feelings brought on by contacts with local authorities and owners of wind turbines also seem to influence the reaction but could be feasible to avoid. Future studies should concentrate on how further wind power developments should be planned and carried out so that wind turbines do not intrude into people living environment and lead to unnecessary adverse effects [77].

More recently in 2017, Ontario researchers conducted a mixed-method, grounded-theory case study of two communities where wind turbines had been operating for several years. A finding was that opposition was "significantly predicted by: health, siting process, economic benefits, and visual aesthetic variables." Although the study reported that a majority of those interviewed supported the turbines, the study focused on the "interplay of that majority with those experiencing negative impacts, particularly related to health." Findings pointed to the "need for greater attention to mitigating impacts, including conflict, by understanding how siting policies interact with social processes at the local level" [78].

Regarding various clinical and research roles, lay stakeholders are becoming involved. For example, Kruger (2019) comments on how she became a "patient expert", giving her an opportunity to work "side by side" with doctors and nurses. Her role as a patient expert has been officially recognized by the director general of her hospital.

One of the difficulties I face with doctors is trying to make them understand that knowing everything about a disease doesn't mean they know what it is like to live with it. Their role is vital, but living with the disease is not part of their expertise, so they are not best placed to advise patients on this issue, that's why having a patient expert in the team helps and results in a better service to patients [79].

The observations of this patient expert suggests there is an opportunity for future qualitative and quantitative research to include subject "experts" on their research teams those who are reporting adverse health and social effects from living near wind turbines.

6. Utilizing a Coding Paradigm

Regarding the Grounded Theory methodology, Rose *et al.* (2015) comment that Strauss and Corbin (1998) "have *proposed* a coding paradigm intended to help with data analysis by suggesting what to look for when coding" and provided a version of this consisting of 5 Elements [49] (*emphasis by Rose et al.*). The 5 Elements and their relationship to the vacated/abandoned home study are published in 2 peer-reviewed articles [2] [3] and were found to be applicable to the vacated/abandoned home study [2]. *See* Figure 3: *Themes and sub-themes and their relationship to the 5 Elements*.

The 5 Elements and their relationship to the analysed data are:

Element 1: the "*central phenomenon*" that is the focus of the study is the siting of an industrial wind energy facility within 10 km of family homes.

Element 2: the "*causal conditions that contributed to the phenomenon*" are described in the themes and sub-themes such as environmental interference, altered perceptions and living conditions that participants associated with an operational industrial wind energy facility within 10 km of their family home.

Element 3: the "*context in which the phenomenon is embedded*" is associated with a government policy resulting in research participants becoming informed and taking action through various processes such as filing complaints and participating in legal/judicial procedures.

Element 4: the "*actions and interactions taken by people in response to the phenomenon*" resulted in participants contemplating housing decisions such as: vacating/abandoning a family home; contemplating to do so; pre-emptively vacating; periodically and intermittently vacating; or deciding to remain.

Element 5: the "*consequences of those actions and interactions taken in Element* 4" include participants' sentiments and expressions of an "aftermath" such as: profound losses; effects related to social justice, rights, personal security; grief, displacement, anger, bitterness, mistrust, stress and anxiety; financial losses and hardship and impact on employment; and effects on relationships.

Figure 3 presents a schematic view of the themes and sub-themes derived from data analyses and their application to the 5 elements. *

It is acknowledged that due to the number of themes and sub-themes and the volume of data that have been collected, the publication of participant descriptions has been limited: these will be available in future peer-reviewed articles.

7. Conclusions

The purpose of this article is to compare the qualitative and quantitative methodologies and to describe the benefits of having used a qualitative methodology, specifically Grounded Theory in order to study why some people contemplate vacating/abandoning their homes when living within 10 km of industrial wind turbines.

The Grounded Theory methodology and narrative approaches were shown to be effective for conducting this research. They provided the opportunity for participants to describe the events that led to their decision-making process. The interview methodology and the collection and analysing of data through an interrelated and iterative process enriched and strengthened the findings. The candid and insightful observations of research participants continually added to the findings and contributed towards answering the research questions and providing an in-depth understanding of the impact of making housing decisions under difficult circumstances. Study participants described their experiences, principles, values, coping strategies, barriers and the risks associated with their decision-making process.

As described in this article, the siting of industrial wind energy facilities in rurally populated areas can challenge a quantitative methodology due to such factors as low population density, obtaining a sufficient sample, and challenges to achieving statistical power and statistical significance.

Grounded Theory methodology served as a practical tool to lend support for the theory that housing decisions of all 67 participants were motivated by the proximity of a wind energy facility within 10 km of their homes and the participants' observations of the occurrence or potential risk of adverse health effects. Some temporarily left during the day and/or night to alleviate their adverse effects.

Goldstein (2001) comments:

The precautionary principle asserts that the burden of proof for potentially harmful actions by industry or government rests on the assurance of safety and that when there are threats of serious damage, scientific uncertainty must be resolved in favor of prevention. Yet we in public health are sometimes guilty of not adhering to this principle [80].

Given that some rural Ontario residents are reporting that housing decisions are in response to living near wind energy facilities, government authorities, researchers, medical and health practitioners, social scientists and policy makers with an interest in health policy and potential disease prevention, and other interested parties have the opportunity to gain an awareness of the risks of placing wind energy projects in proximity to family homes.

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Chesapeake Research Review, LLC ("Chesapeake IRB")

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An interviewee offered the following: "I wanted to thank the people involved with this study. If there's a silver lining to this issue, it's definitely or I'll call it a gold lining it's definitely the people that I've met ... such as (a series of named individuals) such as everybody that sat in that room and the people who will listen to this recording and the people who will crunch the data. I hope that I'm able to convey something of use".

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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